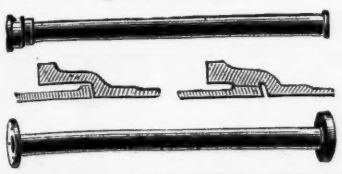
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIX. No. 1758.] LONDON, JANUARY 19, 1897. [49TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1½ to 12 IN. BORE.



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LIMITED.

LANEMARK CANNEL AND GAS COALS.

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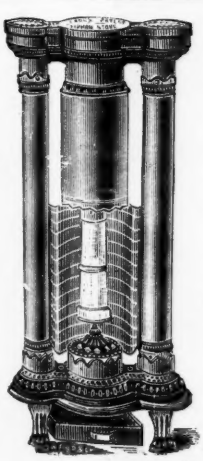

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Used by many Corporations and Gas Companies.

Material and Workmanship of the best.

Prices and full Particulars on application.

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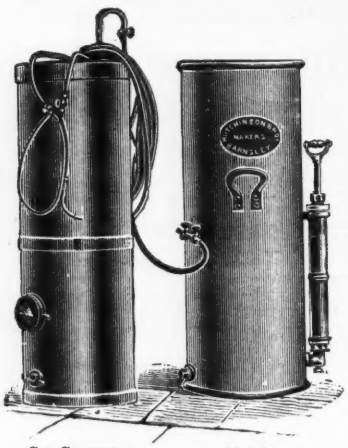

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LEAD WORK FOR SULPHATE OF AMMONIA PLANTS.

BEST QUALITY OF MATERIAL AND WORKMANSHIP.

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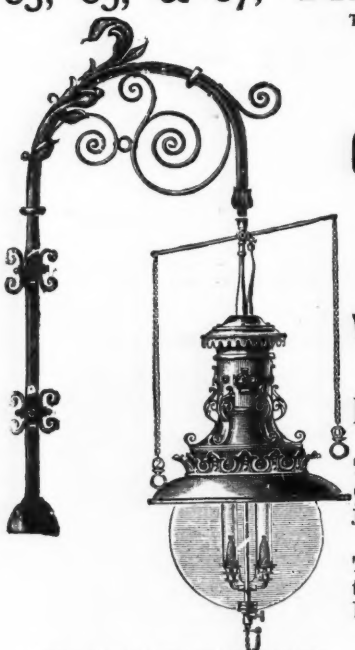

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THE "VERITAS" GAS ARC LANTERNS

(PROTECTED BY ROYAL LETTERS PATENT)

SPECIALLY CONSTRUCTED FOR THE

Incandescent System of Gas Lighting.

Wind, Rain, and Dust Proof.

Enamelled Steel throughout.

Made for One, Two, Three, and Five Lights.

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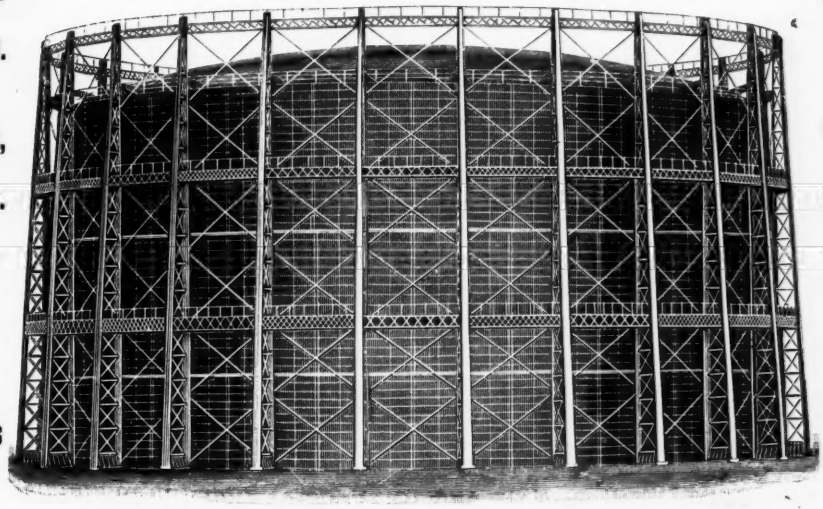

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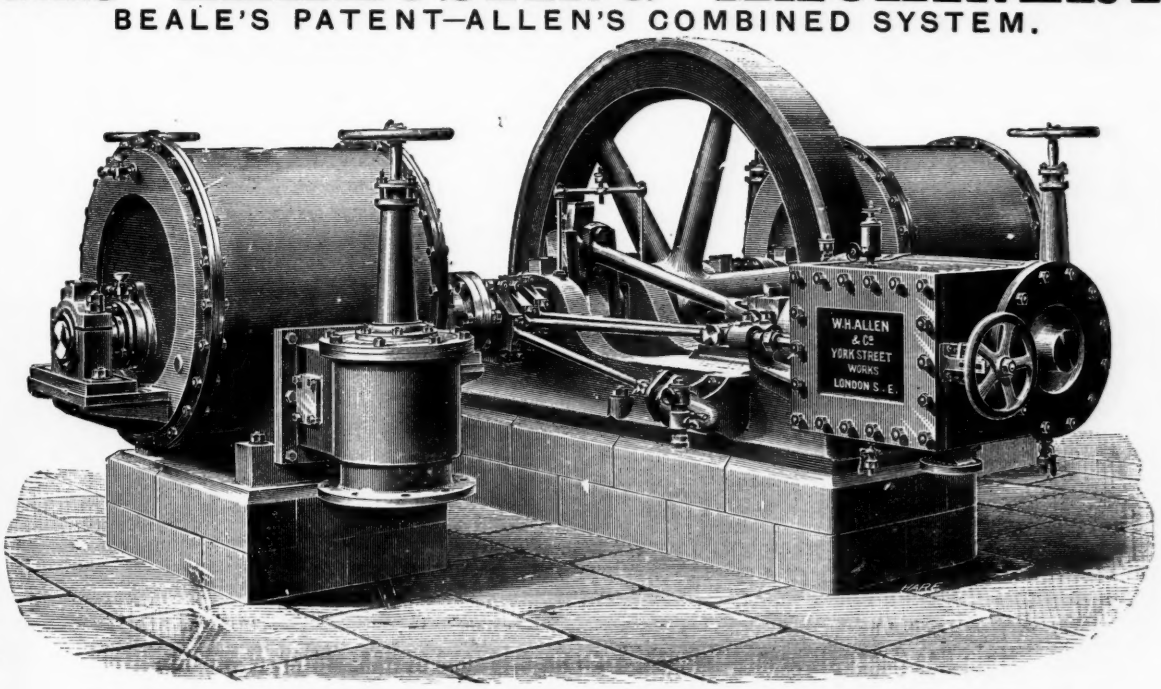

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SCREWS of all sizes.
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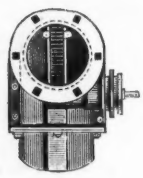

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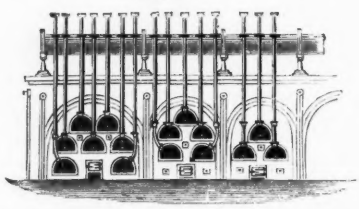

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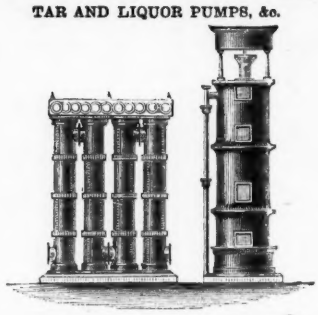

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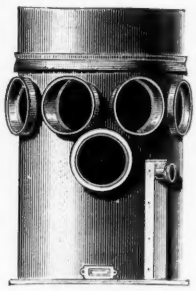
CENTRE-VALVES
for working Purifiers,
Also Bye-Pass & Stop Valves.



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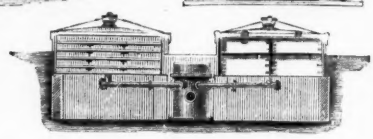

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Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

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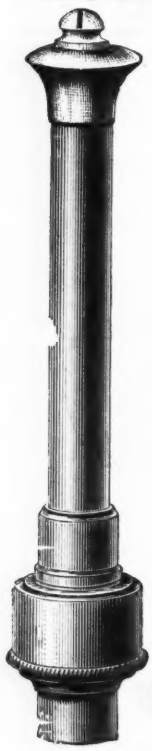

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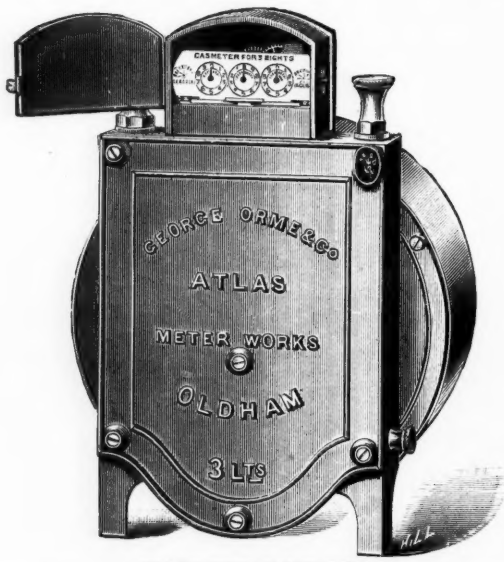

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ORME'S GAS REGULATOR FOR STREET LAMPS.
AS ILLUSTRATION NO. 200,
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Pronounced by Mr. Justice Wills, and confirmed by the Court of Appeal, to be

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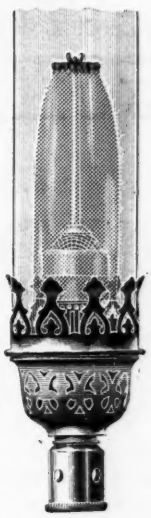

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35-Candle Power from $1\frac{3}{4}$ Cubic Feet of Gas!!!

THE "GEM" BURNER IS SPECIALLY SUITABLE FOR DOMESTIC LIGHTING.
GREATLY IMPROVED DISTRIBUTION OF LIGHT.

It is the Brightest "Gem."
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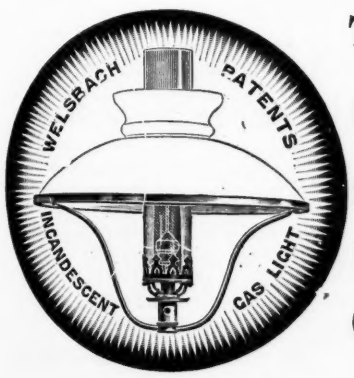

The WELSBACH INCANDESCENT GAS-LIGHT is the

MOST ECONOMICAL
MOST BRILLIANT
MOST HEALTHY
CLEANEST GAS

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THE "GEM" BURNER, 5s. 6d.
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WHICH HAS BEEN FITTED TO MANY OF THE LARGEST GASHOLDERS IN LONDON AND THE PROVINCES, AND IN AUSTRIA, GERMANY, DENMARK, AND THE UNITED STATES.

Full Particulars and Prices from S. CUTLER & SONS, MILLWALL, LONDON.

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ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

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COLUMNLESS GASHOLDERS

ON

PEASE'S STEEL CABLE SYSTEM.

Great Saving in Cost, and Absolutely Reliable in Working.

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ST. AUSTELL
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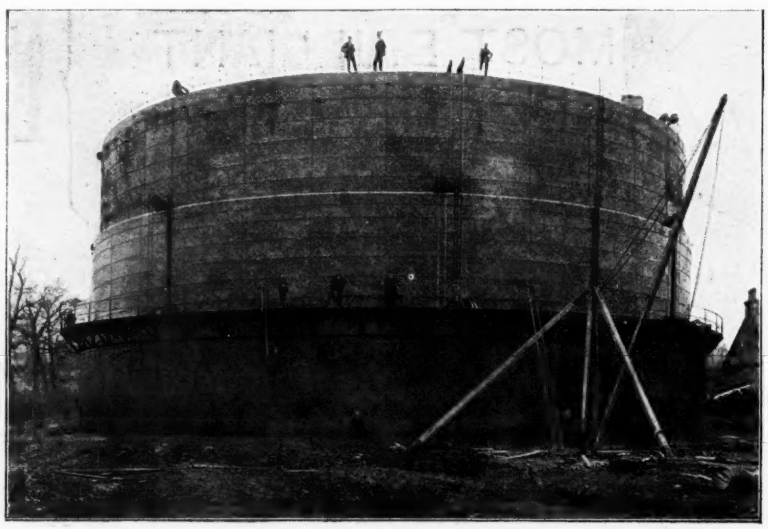
And many other places.



Two-Lift Gasholder with Cup, capacity 488,252 cub. ft.; Steel Tank, 135 ft. dia.; 21 ft. deep.
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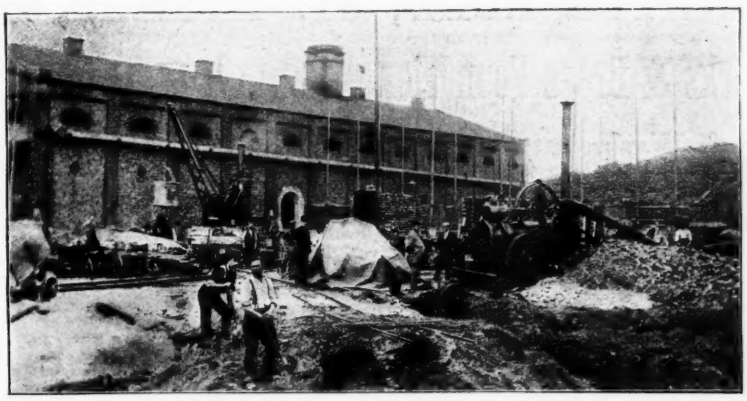

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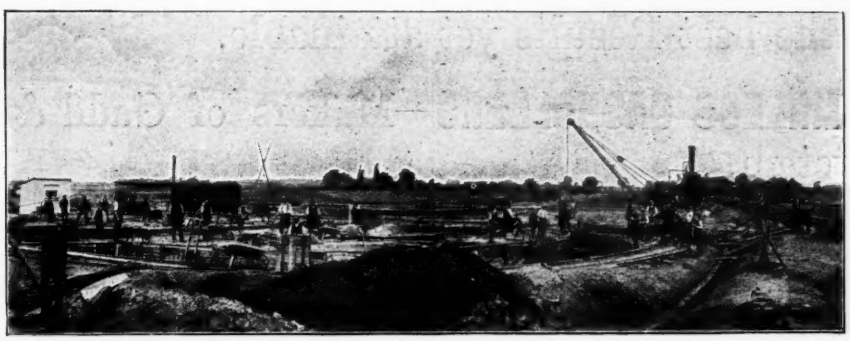

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RETORT WORK OF EVERY DESCRIPTION

(SPECIALITY WORK) ERECTED COMPLETE.

Renewals.

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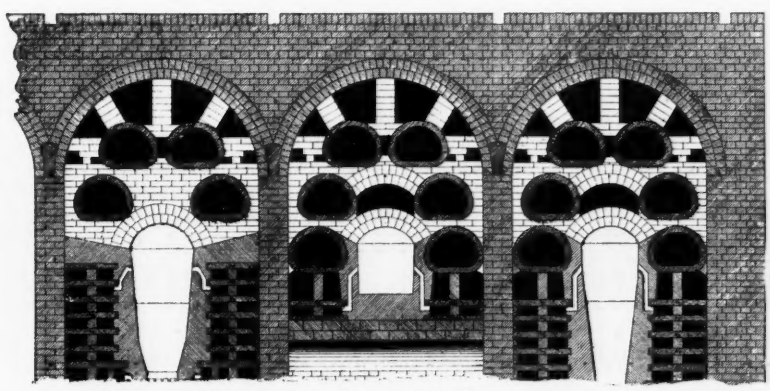

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GAS AND WATER MAIN LAYING.

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WILLEY & CO., GAS ENGINEERS,

CONTRACTORS TO THE GOVERNMENT,

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AND

POWER

MACHINERY

FOR

CHARGING

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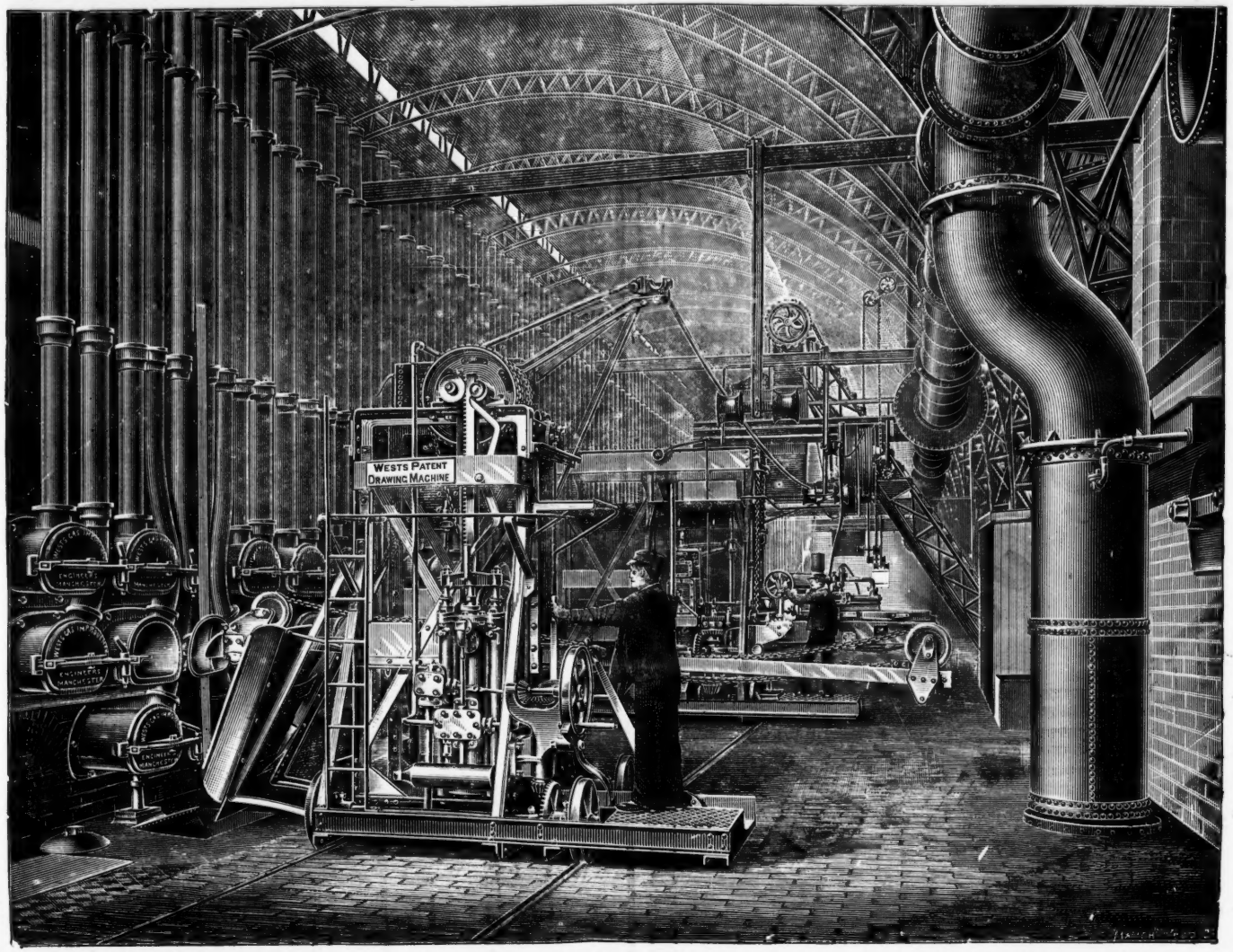
DRAWING

GAS-

RETORTS.



AND

104, Queen Victoria St.,

LONDON, E.C.

OVER

560,000

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FEET

OF

RETORTS

DAILY

ARE CHARGED

AND DRAWN BY

WEST'S

MACHINES.

Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

KIRKHAM, HULETT, & CHANDLER, LD.

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

MARSHALL'S PATENT COMBINED BATTERY CONDENSER AND SCRUBBER.

Extract from letter from Mr. Winstanley, of Coventry: 'The Condensers you erected for us have been in use some time, and are working very satisfactorily.'

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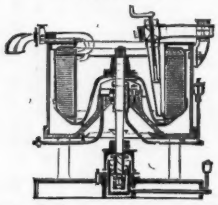
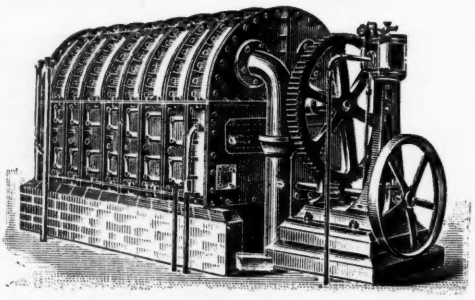


EXTRACTS OVER 99 PER CENT. OF AMMONIACAL LIQUOR FROM TAR.

PATENT "STANDARD" WASHER-SCRUBBER.



OVER 530 MACHINES

In use and in course of Construction.

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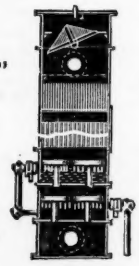

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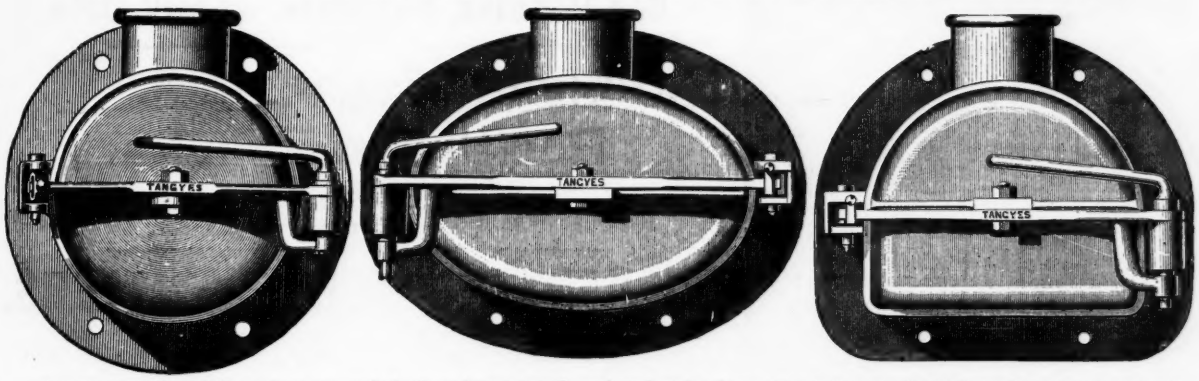

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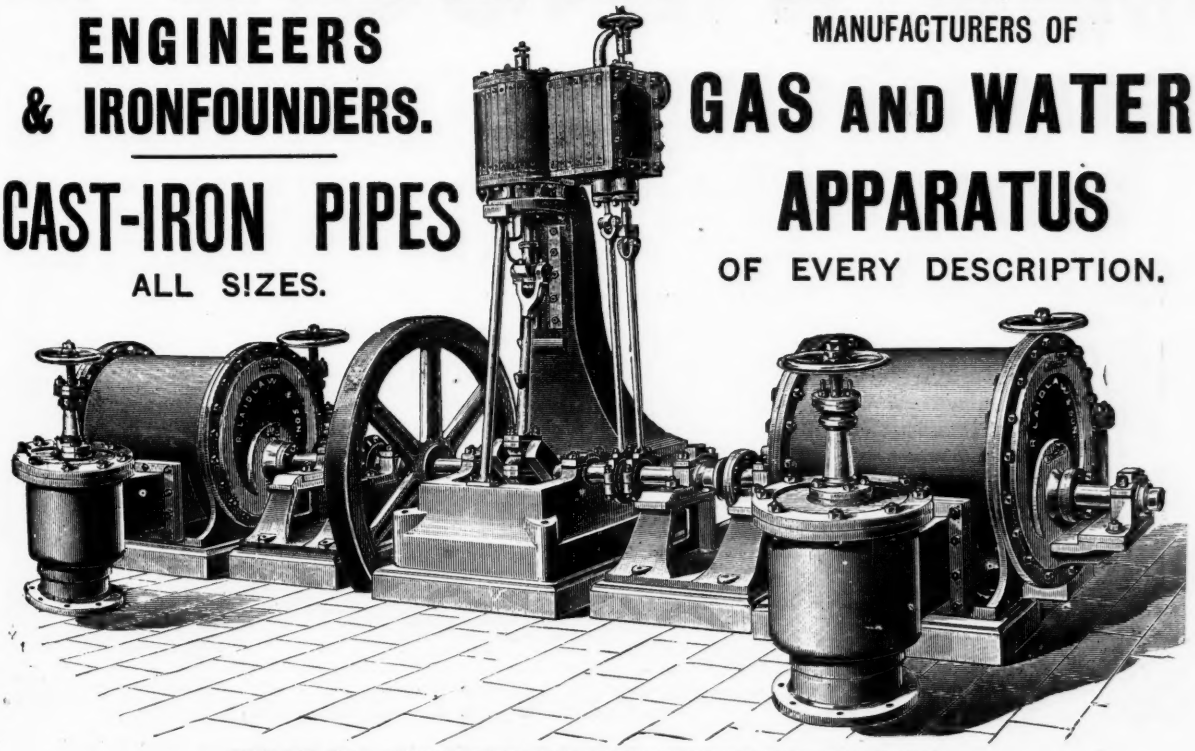

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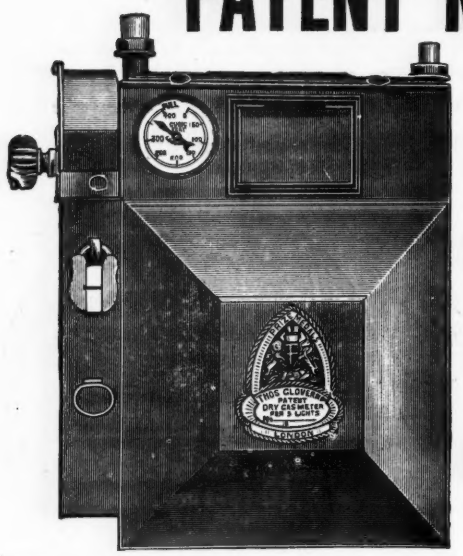

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EDITORIAL NOTES.

Science in 1896.

THE progress of specialization is conspicuous even in the daily newspapers, which by their constitution claim to be storehouses and distributing channels of general information. Thus the usual annual summary of the events of the previous year which our leading daily contemporaries provide for their readers at this season, instead of running on in a solid block of historical narrative, betrays a tendency to split up into a series of articles spread over a number of issues of the paper. A conspicuous example in point is supplied by "The Times," which gave up many columns of its last Thursday's issue to a retrospect of science in 1896, written by no 'prentice hand. It is admitted that the past year was not particularly fruitful in important scientific discoveries, but was marked by occurrences of very great technical and general interest. The production of calcium carbide as a source of acetylene for illuminating purposes is signalized as an application of cheap electricity from which great things are hoped. It is noted that destructive explosions have occurred both in France and in Germany during the manipulation of this gas in large quantities. We are informed that "Berthelot "has investigated the conditions of safety, and finds that "where acetylene is under pressure not much exceeding "that of the atmosphere it is practically safe." But when the pressure exceeds two atmospheres the gas becomes explosive—its explosive energy increasing with the pressure. "In the liquid form, its disruptive force is about "equal to that of gun-cotton; and the gas is liable to "explode either under rapid compression or rapid expan-"sion. Mere shock does not seem to bring about an "explosion of the liquid; but fracture of the containing "vessel by shock is highly dangerous." A great deal of this information is certainly news to us; but at a time when so much technical interest is being manifested in calcium carbide, every scrap of what appears to be authentic intelligence respecting the character and properties of the new preparation is to be circulated for what it may be worth. The reviewer goes on to mention the great demand for cyanides in the gold-mining industry, which has directed attention to the discovery of cheap sources of supply. "Here again the electric furnace "comes into play; bye-products, hitherto left unnoticed, "are carefully treated for the recovery of cyanogen, and "the gas is also obtained in large quantities from waste "ammoniacal liquors." There are reasons, however, connected with the character of their employment, which appear to forbid the prospect of there ever being much profit in cyanogen-recovery processes. As a bacteriological subject, "The Times" writer mentions the introduction, as an article of commerce, of culture-preparations of nitrifying bacteria for the purpose of increasing the fertility of sterile soils. It is remarked upon this that the nitrifying bacteria seem to be of a rather delicate constitution, and that everything will depend upon rendering the soil fit for their propagation.

The Röntgen discovery, and the literature to which it has given rise, are discussed. No explanation of the phenomena is definitely accepted; but the facts are considered to show that inside the vacuum tube from the cathode or negative pole a projection takes place of molecules or atoms of the residual gas which are negatively electrified. This was Crookes's original hypothesis; and it appears to have stood well the criticism to which it has been subjected. "So far the evidence is not strongly in favour of the "view that the X-radiation is a wave motion at all, though "it has the characteristics of some known etherial undu-"latory rays." The writer opines that, in electrical engineering, steady progress has been made in electric lighting and electric traction. "According to statistics, there are "at the present moment about three million incandescent "electric lamps in use in the United Kingdom, one-and-a-"half million being in London alone. In electric trac-"tion, some solid progress has been made, though in this "respect England falls lamentably behind the United "States or the Continent." Mention is made of the discovery of the metal gallium in minute quantity in the Cleveland iron ores, by examination of the spectrum of the flame issuing from the Bessemer converter.

Bitter complaint is raised of the indifference of British iron manufacturers to scientific research. We are reminded

of the vast sums spent in this way by German firms engaged in the coal-tar colour industry; and English manufacturers are once more urged to do likewise. "A research "of altogether extraordinary importance, communicated to "the Chemical Society of London during the year, is that "of magnetic rotatory power, especially of aromatic com- "pounds, by the veteran investigator Dr. Perkin; embody- "ing the results of at least ten years' constant work. The "founder of the coal-tar colour industry, since his retire- "ment, has devoted himself entirely to research work with "ardour and perseverance which few young men exhibit; "and, being highly skilful, his results are of exceptional "value." This most recent work of Dr. Perkin's would not come under our notice in the ordinary way; and we are glad to have the present opportunity of commending to our readers this great example of tireless devotion to the cause of science on the part of one who might well have considered himself to have done enough for his epoch. A curious observation is made concerning the work of August Kekulé, the author of the benzene theory which has been made the very foundation of the modern artificial colour industry, who died last year. "Probably no "one theory has ever before exercised so dominating an "influence over the labours of chemists. Kekulé has told "us that the theory assumed shape in his mind when he "was on the top of a London omnibus."

Altogether, the article in question is a very interesting one; enabling, moreover, a person who wishes to keep himself abreast of the science of the time, yet has neither the means nor the ability to follow all the proceedings of the scientific societies, to form a pretty complete idea concerning the actual additions to the sum of human knowledge made by scientific workers during the past twelve months.

Heavy Damages against Trade Unionists.

A REMARKABLE lawsuit ended last week in a verdict that must be regarded as a heavy blow to militant Trade Unionism. This was the case of *Bailey and Another v. Pye and Others*, in which the plaintiffs, a firm of glass merchants, claimed damages and an injunction against the defendants, who belonged to the Glass Bevellers' Trade Union, for "unlawfully and maliciously procuring certain persons who "had entered into contracts with the plaintiffs to break "such contracts, and for maliciously conspiring to induce "certain persons not to enter into contracts with the "plaintiffs." It was the old story of a strike and the operations of the strikers against the firm and those men who continued to work. Picketing once more passed into molestation; and the evidence in the case, as reported in "The Times" of this day week, is a repetition of the history of many similiar Trade Union performances. The named defendant, Pye, was the moving spirit of the strike. He was proved to have induced several of Messrs. Bailey's workmen and apprentices to break their agreements with the firm, on the old pretence of finding them a better job—promises which were broken as soon as their primary object of withdrawing the men from their employment had been attained. After three-and-a-half days' hearing of this kind of evidence, Mr. Asquith, Q.C., who appeared for the defence, gave it up, and consented to a verdict and injunction against his clients. The jury found a verdict for the plaintiffs for £674, for which amount judgment was duly given, with costs. A perpetual injunction was granted against the defendants, who were also made to promise that no such injurious and offensive expressions as they had been accustomed to use respecting Messrs. Bailey in the publications of their Trade Union should be circulated in the future. This Union is not one of those listed by Mr. John Burnett in his last return; and there is no very hopeful prospect of the defendants being able to satisfy the judgment. The employers, however, will henceforward be able to carry on their business in peace; and the exposure of the folly and bad faith of the Union leaders ought to prevent their being able to find any more dupes such as those who told their tale in Baron Pollock's Court last week. Nevertheless the result of such judgments as this is a scandal. Trade Unionists are never weary of calling for "recognition of the Union" when they have something to gain thereby. In the name of their Union, the officials can organize strikes, pay strikers and pickets, go to law, and employ in many ways all the force of a large and wealthy organization to gain their ends. When they lose an action, as in the present instance, all this quickly disappears. The officials become once more simple workmen, who are not worth powder and shot; and they certainly do not want any "recognition of the Union" in these circumstances.

Widnes Gas Profits Saved.

THE decision of the Local Government Board has been given with respect to the application of the Widnes Corporation for a Provisional Order to amend the clause in their local Improvement Act which defines the method of disposal of the profits of the Corporation gas and water undertakings. According to this Act, the Corporation have no power to do anything with their gas and water profits except pay off debt; and a majority of the Town Council thought last year that having their hands so tied in respect of the administration of these sources of corporate revenue was an undignified position for them to be in. Not that they wanted to get at the Gas and Water Committees' tills—certainly not; nothing could be farther from their mind! They only wanted to be free, like all other Local Authorities in Lancashire. There was no occasion to pay off the debt any faster; and the price of gas was exceptionally low. It might be very convenient to have the gas and water revenues as a stand-by, out of which the district rate could be helped at a pinch; but nobody wished for a moment to do anything to make gas dear. The dignity of the Widnes Corporation was the chief thing at stake, however; and accordingly the Local Government Board were asked to consent to the abrogation of the financial restrictions placed by the old statute upon this august body. All this was very plausible. But the Chairman of the Gas Committee (Alderman Timmis) thought the proposal not altogether so disinterested as it was made out to be; and a considerable number of the townspeople were of his mind. Consequently, a vehement opposition was raised to the proposed Provisional Order, in the interest of cheap gas; and it is gratifying that the Local Government Board have listened to the defenders of this interest, and declined to countenance the changes asked for. The manner in which this official communication was dealt with by the Finance Committee, within whose province it came in the first place, is an illustration of the fact that such public bodies are as prone to be disingenuous as any individual or company having a private interest to serve. The Committee merely entered in their minutes an abstract of the letter, containing the bare announcement that the Provisional Order would not be granted; and here the matter would have ended if a member of the Council had not inquired, when the minutes came up for confirmation, why the full text of the letter had not been given therein. There was no satisfactory answer to the question; but the Mayor had the letter read out, and this enabled the Press to reproduce it for the benefit of the public. It was then found to conclude with a significant reminder that, as a matter of fact, the ratepayers, who did not bear a penny of the burden of the gas and water undertakings standing in their name, do actually benefit by having the town lit at the charge of the gas undertaking. This observation the Finance Committee would have suppressed. Actions of this kind do not tend to induce the consumers of Widnes gas to place much confidence in the Corporation financiers; and they will be doubly grateful now to the central authority that has kept the gas and water revenues safe. Several large consumers have threatened to make their own gas rather than be taxed through the Corporation supply; and this matter was to be specially considered by a Committee. But now that the gas is to be furnished practically at cost price, the consumers in question will have no temptation to take this course. Widnes is to be very heartily congratulated on the result of the inquiry.

The Reform of Private Bill Legislation—Experts and Counsel.

THE subject of the reform of Private Bill Legislation cannot be esteemed, on the face of it, an amusing topic; yet some correspondence in "The Times" has revealed the existence of a distinctly humorous side to the question. The discussion began in the usual way, as has been noticed in these columns, with very portentous suggestions for the creation of new tribunals and new forms of procedure for reducing the cost of Irish and Scotch Private Bills. We have taken the view that much might be done by improving the working of the existing system; and this is the

idea that has at length emerged from the discussion of the subject in "The Times." A writer who seems to "know the ropes" asserted in our contemporary that the most glaring evils of the existing system are six in number: (1) Suitors cannot be heard in person before Committees; (2) costs are not given to petitioners put to expense without justification; (3) expert evidence, besides being costly, is often worthless because insincere; (4) some of the practising Counsel are bullying and discourteous, and ought to be controlled; (5) sufficient attention is not paid to the reports of Government offices on Bills; (6) exorbitant Counsel's and Agents' fees. Another correspondent has attempted to answer this indictment; declaring, as to the first and second counts, that suitors can be heard in person, and that costs are given when interests are unjustifiably attacked. As to the third count, it is genially remarked, "if people will be fools, and employ merely "mercenary experts, they have themselves to blame!" It is admitted that "the tone of the Parliamentary Bar is not so "high as in former days;" and that the Chairmen of Committees might do more to keep unruly Counsel in check. As to the fifth count, it is declared that the utmost possible attention is, as a rule, paid to official reports. With regard to the sixth, it is argued that an inquiry held in 1888 established the fact that the burden of the expense of Private Bills is not caused by the Westminster fees, but by local expenditure, the cost of unnecessary deputations, and so on. To this defence a rejoinder has been made by the first writer, which serves to bring out into clear prominence the points of actual practice in regard to which improvement might be effected without altering anything of the procedure. It seems to be established that petitioners cannot be heard personally, but only, as the form runs, by "counsel, agents, and witnesses." We are not sure how much would be saved by enabling opponents of Private Bills to appear in person. In some cases, where land is proposed to be taken compulsorily, the proprietor might benefit by looking after his interests himself. But experience of private litigants in the Law Courts does not countenance the idea that there is much in this point. We believe it is the truth that costs are rarely given against promoters of Bills who are convicted of having acted unjustifiably. The Dublin Gas Company ought to have had their costs last session against the Corporation; but it was understood to be useless to ask for them. There is practical agreement on all sides as to what should be done with insincere expert witnesses and rude Counsel. Chairmen of Committees ought to be stronger in their dealings with these delinquents. As to the general expenses, whether of Private Bills or of ordinary litigation, it seems hopeless to talk of any remedy. The evil of extravagance in this regard can only be attacked successfully, if at all, indirectly. It can never be anything else than a costly business to promote or attack a really important Bill. But if Agents and Counsel knew that they would have to deal with a strong Chairman of Committee or Official Referee, who would dispose of costs in accordance with his own ideas of what was right and reasonable, much waste of money and time would be avoided. It might be more difficult to mend the manners of the Parliamentary Bar; but if it were made plain that abusive and diffuse Counsel would not be suffered, they would quickly reform themselves.

The Index to Vol. LXVIII. of the "Journal," July to December, 1896, is now ready; and, as usual, a copy will be forwarded (post free) by the Publisher, on receipt of a post-card from any Subscriber.

The Editorial Direction of the "American Gaslight Journal."—Mr. T. J. Cunningham, formerly the Assistant-Editor of the "American Gaslight Journal," has been promoted to the position held by the late Mr. Joseph R. Thomas, who had the editorial control of the paper from 1883 till his death a few weeks ago. Mr. Cunningham will have associated with him Mr. Elbert P. Callender.

The Dividend of The Gaslight and Coke Company.—We learn from the Secretary and General Manager of The Gaslight and Coke Company (Mr. J. W. Field) that the balance to the credit of the net revenue account will, subject to audit, enable the Directors to recommend the payment of a dividend for the half year ending Dec. 31 last at the rate of 12¾ per cent. per annum; carrying forward a balance of £45,747. This time last year, the amount carried forward was £164,121, with the same dividend. The working in the first half of last year allowed the payment of a similar dividend; and a balance of £108,897 was carried forward.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 145.)

On the Stock Exchange during the past week, attention has chiefly been directed to the settlement. Speculative business is still on a small scale; but there is a fair amount of dealing for investment. Stock is being taken up in small amounts; and many people are turning their attention to second and third rate preference securities which seem to have a prospect of appreciating in value. The feature of the week, however, has been the declaration of English Railway dividends. The Brighton and the Manchester and Sheffield announcements were disappointing, and prices dropped; but those of the Great Eastern and South Eastern being satisfactory, values advanced. Consols are fully ½ per cent. higher on the ease in the Money Market, temporary though it may be. The decline, however, in money rates has helped to harden up gilt-edged securities; and among these, we have to record an advance in some thirteen or fourteen of the Gas and Water stocks. The most active dealings have been in Gaslight "A;" very considerable business being recorded. The highest marking was 320. Some inquiry prevailed for Commercial and South Metropolitan; the debenture stock of the latter having recovered part of its dividend. Suburban and Provincial Companies were quiet; the feature among these being the rise of 10 per cent. in Tottenham "A" and "B" stock. Brentford issues were likewise in demand; the new consolidated being 10 per cent. up, at 225-30. In the Continental division, Imperial Continental showed some activity; and the market was strong. The closing on Saturday marked a rise of 10 per cent. on the week; the price being now quoted 218-25. Australian and Metropolitan of Melbourne debentures were likewise better. The European Gas Company announce an interim dividend of 4 per cent., or 8s. per share. The shares of the Cape Town Company have been a little dull; and there is a fall of 1 in the People's Gas of Chicago mortgage bonds. Water stocks have been moderately active; and the market shows an upward tendency—the only weakness being in the Lambeth 10 per cent., which are down to 270-75.

The daily operations were: Gas was fairly active on Monday; the most dealings being in Gaslight A, and in Imperial Continental, which rose 2. Lambeth Water 10 per cent. gained 1; otherwise there was no change. On Tuesday, dealings were again active in Gaslight "A;" and business was done up to 319, but the price was unaltered. Imperial Continental and Brentford consolidated, however, rose 2 each. There was a little more doing in Water; and New River debentures gained 1. The market on Wednesday was less active; but business was again recorded in Gaslight "A" at 319, and in Imperial Continental at 220½—the price having advanced 4. There was a fair amount of business in Water; but prices were unaltered. Thursday was also a quiet day in both Gas and Water stocks; but Gaslight "A" rose 2, and Tottenham "A," 10 per cent. Friday's market remained firm. A rise of 10 points was recorded in Brentford new stock and Tottenham "B;" 2 in Australian; and 1 in Metropolitan of Melbourne 4½ per cent. debentures; but Gaslight "A" fell 2. In Water, Southwark preference rose 1. Very few dealings were recorded on Saturday; but Southwark "D" gained 2.

ELECTRIC LIGHTING MEMORANDA.

The Institution of Electrical Engineers—Sir Henry Mance on British Electrical Engineering—A Danger to a British Interest.

The Institution of Electrical Engineers held an ordinary general meeting last Thursday, when Dr. John Hopkinson relinquished the Presidency of the Institution, and was succeeded by Sir Henry Mance, who is identified with submarine telegraphy—a branch of electrical engineering that has been almost eclipsed from the public eye of late years by the younger developments of electric lighting and traction, with which it has very little in common. Electric lighting and traction engineering came into the inheritance of the submarine telegraph men's victories in respect of cable design and manufacture; but it would be difficult to name two instruments included in one category that differ so widely as the dynamo and the siphon recorder. Still, electricians are electricians, whether their concerns are with the one class of electrical apparatus just named or the other; and so it was quite right and proper for the Institution, which was started by the telegraph men, to be enlarged in the fulness of time to receive the followers of the younger branches of electrical science. Submarine telegraphy suffers in contemporary interest from the completeness with which its aims have been accomplished by the generation of experts who are now fast passing away, together with the generation of the public for whom they laboured, and who applauded them as wonder-workers in their day. It is only by an effort that the younger population of those now engaged in scientific pursuits and in commerce can realize that their fathers had no telegraphic communication with the ends of the earth. So quickly has the

world moved in this respect, that submarine telegraphy—a dream of the "forties" of the present century—is the veriest commonplace of the present day, and has been so for many years past. That it is a great industry, everybody understands; but it is a far greater one than most people are aware of. When it is stated that the cost of repairing a single Anglo-American cable amounted on one occasion to £95,000, this single fact suffices to throw a light upon the importance of the submarine telegraph interest.

The vast industry of submarine telegraphy, as explained by the new President of the Institution of Electrical Engineers, does not owe its creation to any single genius. Sir Henry Mance has come to the conclusion that "to no one individual could fairly be granted the credit of the inception and development of the submarine cable; the work had been the work of many." Now the industry is represented by a capital expenditure of about 40 millions sterling, of which probably 75 per cent. has been contributed by England. Until very recently, every telegraph cable of importance was manufactured in this country; but England has no longer the monopoly of this business. These observations of Sir Henry Mance go to illustrate the folly of the assumption, so frequently advanced by present-day speculators, that any one financial or manufacturing organization can create and keep possession of the monopoly of a development of electrical science and practice. As it has been with submarine telegraphy, so it must be with electric traction and power distribution. There can be no private road to success; but an eventual triumph must be won, if at all, by the hard and painful process of "trial and error," in which all the world is free to take part. Sir Henry Mance had nothing very pointed to say respecting electric lighting and traction. He declared it to be "an acknowledged fact that, in the excellence of design and workmanship, our manufacturers could not be beaten. Our electric light stations were unsurpassed in the excellence and efficiency of their plant, electrical and mechanical, and unequalled in their suitability to the end in view. The best features of the methods preferred by us were all of home growth; and if we had to borrow from American practice in connection with the electric traction movement, we should at least be able to point to our tunnel railways as unique, and to the Liverpool overhead railway as the first elevated electric railway in the world." All this must, of course, be very gratifying indeed to the national pride of British electricians.

There is more in these observations, however, than a mere flourish to a patriotic air. The British electrical interest is reasonably solicitous that whatever there is to be done in the matter of electric traction for railways and tram-lines in the United Kingdom should be done at home. On the other hand, certain owners of tramways which it is in contemplation to equip for electric traction are, not unnaturally, inclined to think that American goods are likely to prove less experimental for the carrying out of what is undeniably an American solution of the problem of mechanical traction. Hence, unless a vigorous and well-sustained effort is made in the interest of the home electrical industry, there is a strong probability, to say the least, that some heavy orders for tramway equipment on the trolley-wire system will go to the United States before the year is out. Such a miscarriage of patronage is manifestly to be deprecated. We agree with our electrical friends, that the idea of going to America for any description of electrical plant is at the best only a plausible inference, and is better qualified as a fallacy. There is no "master patent" in connection with the trolley-wire system; and if the system is to be adopted to any extent in the United Kingdom, every necessary element in it can be supplied here in the highest perfection. There is surely no need to send to America for steam machinery, electricity generating plant, tramcars, electric motors, wire, or rails; and if not for any of these things, then why for the combination of the whole? Such an idea, it may be remembered, once inspired the directorate of the Metropolitan Electric Supply Company, upon their beginning business. They decided to put down two stations—one equipped throughout with English plant, and the other with American machinery of the most approved type, supplied by a manufacturing firm that had at the time more experience of the work than any other establishment. The American station was burnt out some years ago by a merciful fire, after having constituted itself such an object-lesson in the matter of working that, when the station was reinstated, it did not contain a single repetition of the old equipment. This incident of the electric lighting of the Metropolis has been passed over very quietly; but we believe the facts are as stated. We do not say that American electrical engineering is bad for the applications found for it at home; but it is the simple truth that it has failed to establish itself in this country against the competition of native designers and manufacturers in the department of lighting. There is no real reason why the case should be different in respect of tramway working. Indeed, all that is distinctively American in the overhead-trolley system—the rough-and-ready wiring, the reckless speed, the disregard of the amenities of localities and of public safety—have confessedly to be dropped before the system has a chance of finding qualified acceptance here. We notice that the "Electrician" this week has occasion to question the accuracy of some American data referring to the economy of certain unmentioned tramway power stations. Such figures as these are probably intended for export, and are to be esteemed accordingly.

A STRING OF REFLECTIONS.

Upon receiving recently a reprint of a paper read by M. Melon at the last congress of the Société Technique de l'Industrie du Gaz en France, the full title of which is "Comptabilité spéciale au Service des Compteurs a Prépaiement à Lille," we were struck by something peculiar in this title. For some reason, it did not seem to ring like true idiomatic French; and a little further reflection showed that it must be the word *prépaiement* which was strange. Reference to available dictionaries disclosed, as was expected, that, though the idea was known to both French and English people, only the latter language had a single compound word for it, which was "prepayment," the older French rendering being *payement d'avance*. The genius of the French language does not easily permit of the compounding of words; and therefore when the English invention of the prepayment meter invaded the French gas industry, the instrument was designated a *compteur à paiement préalable*. This somewhat cumbrous form has now, in submission to the promptings of the spirit of the age, which is more powerful than the genius of language, been condensed by an eminent technician into the one word already given. That such a process of specialization in language should be necessary is, of course, a consequence of the progress of technical development of the things to which the words are applied. While departments of science, art, or industry, are in the stage of growth, they will of necessity continue to make fresh demands upon the resources of language for the expression of their movement.

All living languages are in a more or less plastic state; but some languages put forth new verbal growths more easily than others. The process of linguistic adaptation to fresh needs is also different in different languages, as a brief consideration of the most modern forms of the three great European tongues—English, French, and German—will show. In English, there is the greatest possible vigour of new verbal growth, which in the mouths of the American people becomes rank luxuriance. In the United States, sheer popular ignorance of the canons of style and the restrictions of grammatical form combine with genius for creating new and striking descriptive words, to produce a *patois* from which serviceable words are continually being taken to form permanent additions to the English language. Every now and again in England itself, new words get into circulation, nobody knows how; and, after a period of probation as "slang," so many of these terms as possess permanent attractions similarly find their proper place in the language. To this growth of new words, many of them monosyllabic, the positive, though limited, toleration of the compounding of words must be added to complete the description of the way in which English grows. In German, on the other hand, agglutination comes much more naturally than new creation as the means of expanding the language. Where an Englishman, and especially an American, would cast about for a sharp, concentrated, easily-remembered word for a new thing, a German will start with an old familiar root, and add to it one qualifying word after another until he gets something that will answer his purpose. We do not know how the coin-freed or prepayment meter will eventually figure in German. At present it is scarcely known in the German gas industry; but when it does become a familiar article of trade and domestic employment, it is quite likely to continue to be designated as a "*selbstverkäufendengasmesser*." A few syllables more or less are of no particular moment here. French differs widely both from English and German in rarely putting forth new words of its own, and in rejecting compound words at almost any cost in respect of point and concentration. It is altogether against the genius of the French language to speak of the "French gas industry;" one must go the roundabout way of saying "the industry of gas in France." It is greatly daring of M. Melon to attempt to compress the meaning of *paiement préalable* into *prépaiement*.

This discussion leads to the reflection that, while the gas industry is unquestionably of British creation, and has furnished the world not only with most of the typical patterns of gas apparatus but also with their names, the prepayment meter is the only considerable novelty with which British gas engineers have of late years endowed the industry. Let us digress here for a moment to remark that, as generally happens in these matters, the difficulty in regard to the nomenclature of the subject which existed a year ago has settled itself. It is to be noticed that the leading English firms of meter-makers have decided upon the simple and sufficient adjectival term "prepayment" as sufficient to distinguish the kind of meter referred to from the ordinary kind. When we last wrote upon this subject, the term "automatic prepayment" was in general use; and we recommended that in preference the term "coin-freed"—an American creation—should be used in cases where the popular "penny-in-the-slot" was inappropriate. We are glad, however, that the suggestion fell to the ground, and that the linguistic sense of English practical men—rarely at fault for long—has once more vindicated itself. "Prepayment meter" is indubitably the proper name for the article; the addition of "automatic" being both unnecessary and essentially improper when read as applying to the act of prepaying for gas in the particular way provided for by these instruments. The meter itself might act automatically upon the inducement of a coin put into it; but the putting in of the coin which constitutes the act of prepayment is certainly not an automatic performance.

To return, however, from this digression. It is a curious fact that, besides the single example of the prepayment meter, no important modern improvement in gas apparatus is to be accredited to British gas engineering. The incandescent gas-burner is the production of Dr. Carl Auer Ritter von Welsbach, an Austrian. The regenerative principle, both for gas-burners and for furnaces, is due to Frederick Siemens, a German. The principles upon which the first practicable gas-engine was made were propounded by Beau de Rochas, a Frenchman, and applied in the design of an actual motor by Dr. Otto, a German. Nobody in particular is responsible for the gas cooking-stove, which is usually an adaptation for a specific purpose of the heating burner devised by Bunsen, a German. To a Frenchman and a Greek—Blondel and Psaroudaki—we owe the only distinct modern improvement in gas-globes. If we look inside the works, the character of the revelation is the same. Perhaps the gas is carburetted by means perfected by Hiram Maxim, an American; or it is mixed for the same purpose with water gas made after the invention and experience of Lowe, another American. It may be made in retorts set at an angle approximating to the natural slope of heaped coal, according to the device patented by M. André Coze, a Frenchman. If we are to believe all reports, the only gaseous illuminant that can rival coal gas is acetylene, prepared after the plans of Mr. Willson, an American.

The foregoing catalogue contains practically all the principal novelties that have been brought into the gas industry of late years; and they are all of foreign origin. This is not to say, of course, that British gas engineers have done nothing for the advancement of the industry in other ways, or have had nothing to do with the development or perfecting of the improvements that will go down to posterity labelled with the names of their foreign introducers. But the fact remains that the present generation of Englishmen can show no names in the roll of those who serve the gas industry equalling in renown the first half-dozen of those foreigners whom we have mentioned.

There is, of course, no help for this in the nature of things. It is one of the glories of England that the best fruits of material civilization, wherever the seed may come from, are produced within her borders. The attraction of English capital and industrial methods is so great, that the springs of material and mechanical progress, when they do not originate in this country, are certain to be transplanted here in order to realize their potentialities to the utmost. The English people are sure to benefit the first and the most largely from every extension of the boundaries of human knowledge, by whomsoever made. This is a true saying; but the fact, as repeated in an infinity of realizations, is too wonderful ever to become a commonplace in eyes that have been opened to it. Whether it is due to capital, to legislation, to commercial methods, to industrial organization, or what not, the result is one of the marvels of the world.

OBITUARY.

Mr. W. Amos Barnes, of Broome Manor, Swindon, died recently of apoplexy. Deceased, who was about eighty years of age, was Chairman of the Swindon Water Company when the undertaking was acquired by the Local Authorities.

The death is announced of Mr. J. Winter, who, until he was pensioned off about a year ago, was Manager of the Bishop's Waltham Water-Works. Deceased, who, was in his 72nd year, was appointed Manager of the works when they were started 33 years ago.

In noticing last week the death of Mr. W. Lynass, the inspector of mains and meters to the Belfast Corporation, the length of his connection with that body and their predecessors, the old Gas Company, was shortened by an accidental transposition of figures. Mr. Lynass entered the service of the Company at the age of 15; and his association with the undertaking extended over 54 years.

PERSONAL.

Mr. F. Edwards has been appointed Secretary to the Okehampton Gas Company, in place of Mr. W. Murrin, resigned.

Mr. C. T. L. Bristow, Mr. R. Goodman, and Mr. W. L. Mansergh have been elected associate members of the Institution of Civil Engineers.

Mr. Arthur Graham, the Engineer and Manager of the Mansfield Corporation Gas and Water Department, has received an increase of £50 a year to his salary.

Mr. A. M'I. Cleland, the Assistant-Inspector of mains and meters to the Belfast Corporation Gas Department, has been promoted to the position filled by the late Mr. W. Lynass.

Mr. Chenery Suggate, Assoc.M.Inst.C.E., of Sheffield, has been appointed Manager of the Auckland (*N.Z.*) Gas Company, Limited—a position for which applications were invited in the "Journal" for Nov. 10, 1896.

Mr. J. Turner has been elected a Director of the West Ham Gas Company, in succession to Mr. T. G. Venables, who has been compelled to relinquish his seat on the Board in consequence of pressure of other engagements.

WATER BILLS FOR 1897.

The following Bills relating to water supply await the consideration of Parliament:—

The Caerphilly Urban District Council Bill recites that the Council have constructed water-works, and are supplying parts of their district with water. The Council desire to acquire the rights and property in a part of their district of the Rhymney Valley Gas and Water Company. The Council seek powers to supply water throughout their district, with the exception of the part of the Pontypridd Water-Works Company's district lying outside the watershed of the River Rhymney. Water-works are to be constructed by the Council, comprising a weir upon the Nant-Cwm-Sarn, an embankment to impound the Nant-cwm-Ceffyl brook, and two other reservoirs. Land for this purpose is to be acquired within five years; and the works are to be executed in ten years. The part of the water undertaking of the Rhymney Company desired by the Council is to be acquired by arbitration within nine months after the passing of the Act. Rates for domestic supplies are to range from 10 to 6 per cent. The sum of £38,000 is to be borrowed for the purchase of the land and the construction of the water-works described in the Bill, besides the amount that may be required to purchase the desired undertakings.

The Chichester Corporation Water Bill is to authorize the Corporation to purchase the undertaking of the Chichester Water-Works Company—who have a share capital of £20,000, with no mortgage debt—in accordance with the terms of a scheduled agreement. The consideration for the transfer is to be the payment of £47,597, subject to increase or reduction if the aggregate value of the stock-in-trade and loose effects should be found to be more or less on the day of transfer than £490. The shareholders are to receive £23 net per original £10 shares. The limits of supply are defined. Meter supplies are to be optional. The water-works are to be improved and extended out of £20,000 to be borrowed for the purpose, in addition to the purchase price. Surplus water profits are to be applied (in the discretion of the Corporation) to reducing the debt or be carried to the district fund.

The Colne Corporation Bill contains a part relating to water. New water-works are to be constructed, comprising an impounding reservoir on Wycoller Beck, sending down compensation water at the rate of 309,793 gallons per 24 hours. Provision is also made with regard to the taking of water during the construction of the reservoir. The works are to be completed within twelve years. The water-rate for domestic supplies is to be 10 per cent. Lock-up shops and empty houses are to be charged by agreement. The sum of £100,000 is to be borrowed for water-works purposes.

The Crowborough District Water Bill is to incorporate a Company with a share capital of £30,000, and power to borrow £7500, for the purpose of supplying water in a district comprising the parishes of Rotherfield, Wittingham, and Buxted, Sussex. The local authorities and others are to have powers to supply or apply for an Act in case the Company do not fulfil their obligations in six years. The water-works to be authorized consist of two impounding reservoirs and pumping-stations on the stream flowing down from Crowborough to Jarvis Brook. The works are to be completed within five years. The rate for domestic supplies is to be 8 per cent. on the rateable value, with 50 per cent. extra for supplies over 700 feet above Ordnance datum. All hotels and schools are to be charged 9 per cent. Charges for public institutions are to be by agreement, determined in default by the County Court judge.

The Deal and Walmer Water Bill is to enable the Corporation of Deal and the Urban District Council of Walmer to acquire the undertaking of the local Water Company. This Company have a capital of £25,192, with £4575 in bonds. The preamble states that it is expedient that the water supply of the district should be constant; but the Company, though frequently requested to give such a supply, have refused or neglected to do so. A Board is to be constituted of equal deputations from the two Local Authorities, with a standing arbitrator. The undertaking is to be acquired, by agreement or arbitration, within three months after the passing of the Act. Rates for domestic supplies are to range from 10 to 7 per cent.; special provision being made for the supply of courts. Meter supplies are to be optional. The two Local Authorities are to pay for the undertaking in proportion to their populations.

The Devonport Water Bill is to repeal section 14 of the Act of 1893, under which the Company were obliged to supply water in bulk to the Stonehouse Local Board. The Stonehouse District Council, in pursuance of facilities obtained under the Act of 1893, have agreed with the Company for the purchase of the Stonehouse portion of the undertaking, and for the apportionment between them of the water-rent payable in respect of the local Government establishments. The Company and the District Council have agreed upon the application for the repeal of the section referred to; and the expenses are to be equally shared between them. Powers granted to the Company by an Act of 1889, for the making of additional water-works, are to be revised and extended for a further period of five years. The Company seek power to make agreements with the Lords of the Admiralty in respect of water supply in bulk or otherwise.

The Eastbourne Water-Works Act is to enable the Company

to raise £100,000 additional capital, carrying the usual borrowing powers. The water-works are to be enlarged by the construction of new wells, adits, and pumping-stations. A pumping-station already in use at Holywell is to be authorized. The new works are to be completed within ten years.

The Eastbourne Corporation Water Bill is to authorize the Corporation to purchase the undertaking of the Eastbourne Water-Works Company. The purchase clause does not contain any limit of time. Additional water-works are to be constructed at an estimated cost of £130,300. The works are to be completed within five years.

The East Warwickshire Water-Works Bill is to enable the Company supplying the Nuneaton district to raise £24,000 of additional capital, with the usual borrowing powers. The works are to be enlarged by the construction of a well and pumping-station in the Parish of Polesworth, to be completed within seven years. Hose-pipes for window-washing are to be prohibited, under a penalty of 40s., without prejudice to the Company's right to recover damages. After the new works are completed, it is sought to raise the rates for domestic supplies by 25 per cent.

The Fylde Water-Works (Transfer) Bill is to constitute and incorporate a Joint Water Board, consisting of representatives from the Local Authorities of Blackpool, Fleetwood, Lytham, St. Anne's-on-Sea, and Kirkham, to take over the undertaking of the Fylde Water-Works Company. The members of the Board are to be allowed their travelling expenses. The undertaking is to be acquired by agreement or arbitration; no time-limit being fixed. The Board desire power to issue capital stock. The different districts united under the Board are made liable for the finances in proportion to their rateable values. Surplus water profits are to go in reduction of charges.

The Gravesend and Milton Water-Works Bill is to enable the Gravesend and Milton Water-Works Company to increase their capital by £20,000, with the usual borrowing powers.

The Gravesend Corporation Water Bill is to transfer to the Corporation the undertaking of the Gravesend and Milton Water Company. The property is to be transferred compulsorily within six months after the passing of the Act; no allowance being made in the ascertained price for back dividends for more than six years. Officers and servants of the Company not retained are to receive two years' pay. The sum of £30,000 is to be borrowed for water-works purposes, besides the selling price.

The Gravesend and Northfleet Water Board Bill is a measure to constitute a Joint Water Board representing the two localities named, to take over the undertaking referred to in the preceding Bill, with which most of its provisions are identical. This Bill, however, proposes that the surplus water profits shall be divided between the constituent authorities, in the ratio of their gross assessable values, and be by them applied to the relief of the rates.

The Harrogate Water Bill is to enable the Company to raise £72,000 of additional capital, with the usual proportion of loan capital; and to construct new works, comprising an impounding reservoir on the Scargill Beck, to be completed within seven years.

The Harrogate Corporation (Water-Works Transfer) Bill is to authorize the Corporation to acquire the undertaking of the local Water Company, by agreement or arbitration. Rates for domestic supplies are to range from 10 to 5½ per cent.

The Hunstanton Water and Gas Bill is to dissolve the Hunstanton Water Company, Limited, and reincorporate the proprietors, together with those of the Gas Company, as a new Company. The water limits are to be the parishes of Hunstanton, Barrett-Ringstead, and Heacham, Norfolk. The Company are to fulfil their obligations as to supply within five years. The original water stock of the Company is to be £7200, to which £12,800 of new 7 per cent. water stock is to be added, with the usual borrowing powers. Rates for domestic supplies are to range from 9 to 6½ per cent.; the former rate applying to all inns and hotels. For meter supplies, the price is to be 2s. per 1000 gallons up to 50,000 gallons per quarter, and 1s. 6d. per 1000 gallons beyond. The minimum charge for a meter supply is to be £1 10s. per annum. Water for public sanitary purposes is to be supplied at 1s. 6d. per 1000 gallons.

The Lowestoft Water and Gas Bill is to enable the Company to increase their general capital by issuing £100,000 of additional capital, carrying the usual borrowing powers. A scheme for the consolidation of the Company's preference stocks into a uniform 4 per cent. preference stock is to be sanctioned any time before the end of 1898. New water-works, comprising two filter-tunnels and a pumping-station, are to be constructed within fifteen years. The Company having in 1887 sold their market undertaking to the Corporation, desire to change their name to that of the Lowestoft Water and Gas Company.

The Luton Water Bill is to authorize the Luton Water Company to consolidate and convert their existing share capital of £20,000 of original and £30,000 of additional, into £82,000 of 5 per cent. stock, to which £40,000 of new capital is to be added with the usual loan capital. Certain sections of the Company's Act of 1865 are to be repealed. Additional lands to the extent of 5 acres are to be acquired by agreement.

The Newhaven and Seaford Water Bill is to incorporate a Company originally formed by the consolidation of two Companies supplying Newhaven and Denton, and East Blatchington and Seaford respectively. The Company are to fulfil their obligations as to supply within five years. The capital is to be fixed at £60,000, equally divided into original and additional capital, with the usual borrowing powers. The water-works comprise a well and pumping-station at Norton Bottom, in the parish of Bishopstone. Rates for domestic supplies are to range from 9 to 6½ per cent., with 9 per cent. for all inns and hotels. Meter supplies are as in the Hunstanton Bill.

The New Hunstanton Water and Gas Bill is to enable the District Council to acquire the undertaking of the Hunstanton Water Company, Limited, by agreement or arbitration, for a sum in gross. The rate for domestic supplies is to be 1s. 6d. in the pound; meter supplies optional. The sum of £5000 is to be borrowed for the improvement and extension of the undertaking. Surplus water profits are to be added to the district fund.

The Rhymney and Aber Valley Gas and Water Bill proposes to incorporate a Company for the supply of water within a district over parts of which the Rhymney Valley Gas and Water Company, the New Tredegar Gas and Water Company, the Caerphilly Gaslight, Coke, and Water Company, and the water-works of the Rhymney Iron Company exercise statutory or customary rights of water supply. The water capital of the new Company is to be £150,000, with the usual borrowing powers. The undertaking of the Rhymney Valley Gas and Water Company is to be transferred to the new Company, in consideration of the issue to the proprietors of £30,000 in fully-paid water capital. The other undertakings mentioned are to be acquired. The water-works are to consist of an impounding reservoir, to be formed on the Rhymney River, subject to the obligation to discharge compensation water into the stream at the rate of 300,000 gallons per day. The works are to be completed within ten years. Rates for domestic supplies are to range from 10 to 6 per cent.

The St. Neot's Water Bill is to incorporate a Company for supplying water to St. Neot's and Eynesbury, Huntingdonshire. The capital is to be £12,000, with the usual borrowing powers. The supply is to be obtained by pumping from wells near the River Ouse. The works are to be completed within five years. The rate for domestic supplies is to be 10 per cent.; and meter supplies are to be at an agreed price. The Company seek power to make contracts with public bodies for the supply of water for public purposes, and also for the supply of fountains or for any ornamental purpose. A clause is inserted providing that a penalty of £5 shall be incurred for wilfully or by culpable negligence leaving taps open to waste water. The statutory powers over the district of the East Huntingdonshire Water Company are to be repealed.

The Weymouth Water-Works Bill is to extend the limits of supply to embrace the parishes of Bincombe, Broadway, Upway, Chickerell, and the former parish of Buckland Ripers. The sum of £60,000 of additional 5 per cent. capital is to be raised, with the usual proportion of loan. New water-works are to be sanctioned, to be completed within seven years. An agreement of the Company with the Admiralty is to be confirmed. Any preference stock issued by the Company may be made redeemable.

The Work of the Patent Office in the Past Year.—The business of the Patent Office in the twelve months ending December last was greater than ever; the applications filed numbering 30,165—an increase of about 5000 as compared with the year 1895. A considerable proportion of these were in connection with inventions relating to lighting by electricity, incandescent gas, and acetylene.

Incorporated Institution of Gas Engineers.—We learn from the Secretary of this Institution (Mr. Thomas Cole, Assoc. M.Inst.C.E.) that the annual meeting will be held at the offices on Saturday, the 6th prox., for the transaction of the formal business; and that the adjourned meeting will take place at the Institution of Civil Engineers on Wednesday and Thursday, the 5th and 6th of May.

Received.—"The Local Government Annual, 1897." (London: S. Edgecumbe-Rogers.) The present is the sixth year of publication of this handy Official Directory, the contents of which have been re-arranged and improved. Among the new features introduced is an abstract of the Local Government Legislation in 1896; and in the list of Rural District Councils, the Surveyor's name is substituted for that of the Medical Officer of Health. These are evidences of the desire of the publisher to increase the utility of the book.——"Analyses of the Accounts of Gas Companies and Corporations, 1895-6." (London: John Allan and Co.) In these "Analyses," which are a continuation of previous issues, the accounts of eighteen Companies, sixteen Corporations, and two Urban District Councils are dealt with; the items of revenue, expenditure, and profit being worked out at per ton of coal carbonized and per 1000 cubic feet of gas made and sold, with the proportion due to lost gas. The compilers, in their preface, disclaim any pretension to actual exhaustiveness; their endeavour having been to select fundamental factors which may be used for obtaining other figures. The analyses are in each case accompanied by explanatory foot-notes. The book is bound in limp cloth, lettered.

NOTES.

The Transmission of Heat through Metal Plates.

The thermal conductivity of sheet metals has been experimented upon at the Reichsanstalt, Charlottenburg, by Dr. Wiebe and R. Schwirkus, preparatory to a general investigation of the transmission of heat. So far, there have been examined in this way eleven plates, of different makes of steel, wrought iron, and copper. These plates were inserted into the bottom of a boiler which was filled with a weighed quantity of water and placed over the gas-furnace; the heat transmitted through the plate in every case being calculated from the weight of water evaporated. In all, 78 experiments were made with the steel plates, 35 with the wrought-iron, and 12 with the copper. In the first place, the plates were used just as they came to hand; and the metal was then thinned down by turning away the surface from the inside. The outer surface, exposed to the furnace gases, remained unaltered. In several instances the inside surface was covered with artificial boiler incrustation composed of sand and cement, or with an oil mud composed of powdered boiler incrustation and a very tough oil. The experiments went to show that the condition of the steel and iron plates, the state of their surfaces, and their thickness, had very little influence upon the quantity of heat transmitted. The resistance to the transmission of heat between the furnace gases and the water in the boiler is something which is very little affected, if at all, by the internal conductivity of the metal which separates them. The experiments further showed that the artificial incrustation up to the thickness used (about $\frac{1}{8}$ inch) had little influence on the result. It took rather longer for the furnace to boil the water in the first place, when the plate was incrusted; but afterwards there was no apparent difference.

Electrolysis in Brooklyn.

The Electrical Subway Commission of Brooklyn, New York, have presented their last report to the Mayor. With regard to the subject of the electrolytic corrosion of underground pipes and cables in neighbourhoods traversed by the trolley-wire tramways, the reporters observe that the matter still demands serious consideration. As the result of a thorough examination of the street mains and services in the danger area, the gratifying conclusion was arrived at that in the districts where underground pipes are most liable to destruction by electrolysis, the cast-iron water-mains remain intact. Wrought-iron and lead pipes deteriorate steadily and rapidly, in places where cast iron shows no sign of decay. The ordinary white cast iron of which the water-mains are composed is regarded as practically proof against oxidation. The destruction of the wrought-iron and lead water and gas service-pipes is, however, a sufficiently serious matter. It is not only that the leaky service-pipes represent so much loss of capital and waste of water and gas, but trees are killed, the health of the neighbourhood suffers, and the danger of explosions in cellars and manholes is increased. Moreover, the need of incessant repairs to these pipes means frequent disturbance of the street pavements. In some places, service-pipes extending beneath the tramway tracks have been repeatedly destroyed and removed, each removal, of course, entailing an excavation, refilling, and relaying of the pavement. The trolley system companies have during the past year done much to keep the destructive current within its proper bounds; but a means of absolute prevention of the injury, so long as the pipes are of a kind likely to corrode, is not yet made known. The Commission regard the escape to earth of a portion of the current discharged into the rail as a condition inseparable from the single trolley system; and they consider that, in the circumstances, some new kind of metallic service-pipe for gas and water is desirable.

An Intensive Coke Furnace.

Mr. H. L. Gautt has described before the Chemical Section of the Franklin Institute a coke-fired furnace designed to produce a temperature of from 1000° to 2000° higher than that of the Siemens regenerative furnace; and so to attain the objects at present only possible for the electrical furnace. Mr. Gautt starts from the datum of a coke-fired crucible steel-melting furnace, blown with a cold blast. As the temperature of the molten steel in this case is about 3000° Fahr., he concludes that the fire must reach a temperature of 4000° Fahr. in order to melt it. Mr. Gautt's idea is to heat the blast to 3000°; and by adding (say) two-thirds of this heat to the furnace, he assumes that a fire temperature of at least 6000° Fahr. may be reached. The arrangement for attaining this object resembles a blast-furnace, inasmuch as it is a shaft furnace fired with coke, and blown through tuyeres; but it differs from the blast-furnace in using regenerators instead of hot-blast stoves. At the same time, the regenerators are something more than is ordinarily included in this term; for in these chambers the combustion of the blast-furnace gases is completed by means of hot air. To obtain these conditions, a Siemens regenerative furnace is constructed with a pair of regenerators. If these regenerators are connected with each other by means of one or more passages near the top, the hot air will be divided into two streams—one going to the furnace and promoting combustion therein, the other passing directly to the outgoing regenerator, and completing in it the combustion of the producer gas. By a suitable arrangement of air-ducts and a change valve, the gain of temperature in the furnace is supposed to be limited only by the endurance of the material of which it is constructed. Mr. Gautt takes the temperature of formation of calcic carbide in the electrical furnace at not more than 5500° Fahr.; and he thinks his proposed coke furnace will be able to compass this temperature with ease. Such a furnace should not only produce calcic carbide under favourable economic conditions, but also be useful in the production of cyanides. Dr. J. W. Richards thinks the metallurgical principles of Mr. Gautt's proposed furnace sound; but he remarks that the construction of such an appliance to withstand the indicated temperatures will not be an easy matter. He suggests that the furnace should be lined with magnesia, and be water-jacketed.

Tests of Brickwork.

Mr. W. C. Street has presented to the Royal Institute of British Architects an interim report of the Science Committee on the tests of brickwork conducted by this body. A number of brickwork piers have been put up and crushed; and the Committee are proceeding to experiment upon short lengths of walls built without closers, and of a more perfect bond than can be obtained with piers 18 inches square. When these further experiments are complete, the Committee will be ready to make a final report upon the whole series, in which they expect to be able to lay down reliable rules as to the safe bonds for the various kinds of brickwork with which they have been experimenting. It is interesting, in the meantime, to note the great difference between the strength of bricks and of brickwork; the enormous disproportion being due to the quality of the material added to the bricks as a means of uniting and holding the mass together. The effect of this upon different kinds of bricks varies, owing to some bricks being more susceptible of adhesion than others. Again, if the mortar is not well mixed, or the joints and beds of the brickwork imperfectly filled up, the injurious effect on the strength of the whole is incalculable. The results of the tests so far were admitted to be very irregular; so that while one architect considered them to show that common brickwork is much stronger than is generally supposed, another arrived at an exactly opposite conclusion from the same evidence.

Mixtures of Acetylene and Air.

M. Le Chatelier, the well-known French scientist, has been carrying out some experiments on the combustion of mixtures of acetylene and air; and a few particulars in regard thereto were given recently in the "Journal of the Society of Chemical Industry." When such mixtures contain less than 7·7 per cent. of the combustible gas, they burn with a yellow flame, the brightness of which increases with the proportion of gas. The combustion is complete. When they contain from 7·7 to 17·3 per cent., the flame is blue, and carbonic oxide and hydrogen are formed in addition to water and carbonic acid. At 17·3 per cent., part of the gas remains unburnt, and carbon is separated, which, with proportions above 25 per cent., forms a black opaque cloud. Mixtures containing between 2·7 and 67 per cent. of acetylene are explosive; but mixtures of coal gas and air are not explosive until the former reaches 8·1 per cent. Acetylene is much more inflammable than other gases, even than hydrogen; the temperature of ignition being about 500°. The temperature calculated for the flame of acetylene burning in air is 2400°; that of coal gas being 1900°. The separation of carbon from the acetylene flame may be overcome by consuming the gas under considerable pressure from burners with a fine orifice, or, more conveniently, by mixing the gas with its own or twice its own volume of air. This does not reduce the illuminating power. The use of 10 to 20 per cent. of oxygen would, however, be preferable to that of air. To obtain these mixtures, the principle of the bunsen burner might be used to obviate the storage of mixtures.

Photographic Spectroscopy in Colours.

An interesting use of the white light of the Welsbach gas-burner is made in connection with the colour-photography of Mr. F. E. Ives. By this system, which has just been brought into a practical shape by years of study and experiment, three photographs of any coloured object or scene are taken from the same point of view, through three glasses reproducing as perfectly as possible the three primary colours of the solar spectrum—red, green, and blue-violet. Three transparent positives are prepared from these impressions, and these are either placed in a three-tier projection lantern carrying glasses of the same colours, and the superposed images thrown upon a screen, or they can be viewed directly through a pattern of spectroscope devised for the purpose by Mr. Ives. In the latter case, a Welsbach burner is found the most convenient source of white light for illuminating the pictures; and when the light is broken up by coloured glasses, as in the lantern, the effect is to reproduce in the visual image all the tints which existed in the original object as the result of the combination of the three primary colours. It is not by any means easy to explain in words how this effect is produced; but the experimental fact is undeniable. Hence colour-photography is, in a sense, an accomplished fact—not that the photographic print exhibits any colours of its own, but when a triplex photograph taken by the Ives method is viewed as one picture through the same system of coloured glasses as those used in the camera, by the aid of a suitable light, the original colours do reappear in all their natural tints and shades.

TECHNICAL RECORD.

THE MANUFACTURE OF SULPHATE OF AMMONIA.

At the Meeting of the Gas Engineering Society held on the 13th inst., Mr. C. TANNER, junr., read a paper on "The Manufacture of Sulphate of Ammonia from Ammoniacal Liquor."

The author, who is in charge of the sulphate plant at the Old Kent Road station of the South Metropolitan Gas Company, and has had experience with both the continuous and the intermittent methods of working, gave a full description of the plant employed, including the still, saturator, liquor-tank, liquor-heater, &c., and called special attention to many small improvements which, at slight extra cost, greatly facilitate operations. Among these might be mentioned the fixing of gauge-glasses at the bottom, middle, and top of the still, and the provision of a catch-vessel on the pipe which leads away the gases from the saturator, to prevent waste of acid. Dealing with the working of the plant, Mr. Tanner stated that, in his experience, if the steam supplied were at a comparatively high pressure—say, 100 lbs. instead of the usual 50 lbs.—the whole apparatus worked much better, and gave more satisfactory results. This was attributed to the dryness of the steam at the higher pressure. With reference to the valuation of liquor, Mr. Tanner tested samples experimentally before the audience, by the three usual methods—viz., Twaddel's hydrometer, saturation, and Wills's distillation test; and he explained why the two first methods were unreliable, and should only be used when time does not allow of the use of the Wills test. Some interesting figures were then presented showing the differences in the results given by the several methods, as follows:—

	Twaddel.	Saturation.	Distillation.
Hydraulic main liquor	15·80 oz.	.. 0·80 oz.	.. 16·3 oz.
Condenser	4·20 ,,	.. 4·00 ,,	.. 5·0 ,,
Liquor as supplied to sulphate works	4·00 ,,	.. 6·20 ,,	.. 7·2 ,,

Mr. Tanner then dealt with the liming of the liquor to liberate the ammonia from the "fixed" salts—amounting to about 1 oz. per gallon of liquor; and he concluded his paper by describing the working of the Claus kiln, which is used in connection with the sulphate plant at the Old Kent Road.

A short discussion followed the paper; and a hearty vote of thanks to the author for the trouble he had taken in preparing it, and the diagrams, models, and experiments which illustrated it, terminated the proceedings.

NOTES ON CARBURETTED WATER GAS.

By A. G. GLASGOW, M.E.

[A Paper read before the Cleveland Institution of Engineers at Middlesbrough, Jan. 11, 1897.]

Similarity to Coal Gas.—Chemically speaking, there is no such gas as carburetted water gas or coal gas; these being merely commercial terms designating the finished products of two industrial processes, each yielding complex mixtures of a large number of individual gases. Furthermore, in spite of the widely-different apparatus, processes, and raw materials employed, there is no appreciable difference in the qualitative analysis of these two products—that known as carburetted water gas containing only the elements, and practically all the elements, present in coal gas; the two mixing in any desired proportion to form an intermediate product quite as homogeneous as either of the originals, and with quite as much right, as far as chemical constitution is concerned, to a distinctive name. In other words, the names serve to distinguish the utterly dissimilar methods of manufacture, rather than the manufactured products. It is well to emphasize this qualitative similarity, since even now opposition to carburetted water gas is occasionally raised upon the assumption that the "new" product is a complicated and tentative mixture hitherto unknown to the gas industry, and certain to introduce hitherto unheard-of difficulties.

Early Status in America.—As this and other *bonâ fide* misconceptions have resulted from American misstatements, promulgated during the incipient days of carburetted water gas, and never sufficiently exposed in other countries, I shall venture to give here a page from the unwritten history of the American development of the process, illustrating the origin, character, and natural death of these cabals, as well as the marvellous rapidity with which coal gas has been almost suspended in the United States.

When carburetted water gas was first brought to the notice of the American gas industry, the failure of the then existing companies to recognize that the wide difference in the methods of production did not apply to the character and mission of the finished products led them to reject the new scheme. This rebuff urged the promoters to the ill-advised action of employing the new process as a competitor with the established interests; soon earning them the reputation of speculative raiders, and changing the passive attitude of the companies into one of strong commercial antagonism. As the carburetted water gas faction waxed stronger, the whole resources of the vested coal gas interests were aroused; and war was waged with intense bitterness. The daily and technical press were involved; numberless pamphlets heaped abuse upon the new process; political wire-pullers were employed to engineer prohibitive laws through legislative assemblies; and a crisis was reached—approaching a panic among investors—that demoralized the business and threatened to leave it, in some quarters at least, at the mercy of the electric light, then in the zenith of its popularity. Thus hysterical anathema usurped the prerogative of legitimate criticism; and no statement in condemnation of carburetted water gas was so extravagant that authority could not be found in print for its belief.

Evolution of the Apparatus.—Fortunately, at this stage the various interests representing the Lowe process were consolidated; absolute control passing into the hands of the United Gas Improvement Company, organized for the purpose of operating gas-works on its own account. Under the general superintendence of Mr. Alex. C. Humphreys, the days of "slick" promoting and plausible representations gave place to engineering skill of a high order; and henceforth the technical and practical side of the process received unremitting scientific attention. Each of the forty gas-works eventually acquired by this Company was in turn equipped with plant embracing a carefully thought-out advance upon the then most efficient type of apparatus; and likewise earlier installations were continually altered and reconstructed in accordance with the line of progress marked out by later apparatus. Thus each progressive step demonstrated its pronounced commercial utility, as compared with all known alternatives, before being included in the development of the process; and changes that proved retrogressive in their results could be eliminated with certainty after the experience afforded had been recorded.

In this manner a clear connection between cause and effect was maintained throughout the Company's heterogeneous system (at one time comprising every known water-gas process), until a uniformly excellent practice could be intelligently established by incorporating in one perfected design of apparatus the most advantageous qualities of the whole. The ultimate result of this broad adaptation of the principle of natural selection was the evolution of the Humphreys "double superheater" apparatus.

This closes the first and stormy chapter in the history of carburetted water gas. The same conscientious method of development has been continued to the present day, and has led to many revisions of the original "double superheater" apparatus. But every attempt to depart from it in principle has proved retrogressive, and indeed has been practically a revival of some of the old discarded types.

Extension of the Apparatus.—To show that virtue, though its own, is not its only reward, I may add that during the ten years that have elapsed since Mr. Humphreys designed his first example of the "double superheater" apparatus, the United Gas Improvement Company and Messrs. Humphreys and Glasgow have jointly constructed 270 sets of this type of plant, aggregating a daily output of 166 million cubic feet; in addition to which the 16 sets of The Gaslight and Coke Company have a capacity of 10 million cubic feet per diem. It is also to be noted that 89 per cent. of the above total has been constructed since 1890, in an increasing ratio. But it is still more significant that every company in the United States formerly in bitter opposition to carburetted water gas is—without one exception—now operating the Humphreys "double superheater" apparatus, generally to the entire exclusion of coal-gas manufacture. It is conservative to say that 75 per cent. of all the gas now manufactured in the United States is carburetted water gas.

I will end this historical sketch, by relating a single practical instance of the character of the early opposition to carburetted water gas.

Massachusetts Legislation.—Principally through the all-powerful influence and blind partisanship of the Boston Gaslight Company, the State Legislature was induced to pass a law that actually prohibited the manufacture of carburetted water gas in the Commonwealth of Massachusetts; some years elapsing before the representations of such influential men as Mr. Olney, now Secretary of State for the United States, led to its repeal as a commercial immorality. And as a perfect example of the irony of fate, we now find the Boston Gaslight Companies among the largest manufacturers of carburetted water gas in America. There could be no clearer demonstration of the futility of the artificial restriction of natural progress for selfish ends.

The descriptions immediately following of the theory, design, and operation of modern carburetted water-gas plant are largely taken from the author's previous writings.

FUNDAMENTAL THEORY.

Decomposition of Steam.—Water gas derives its name from the fact that three-fifths of its weight and three-quarters of its bulk consist of the oxygen and hydrogen obtained by the decomposition of steam. Steam cannot be decomposed by the direct action of heat alone; but when subjected to a high temperature in the presence of certain "reducers"—that is to say, certain substances which at such high temperature have stronger affinity for the oxygen of the steam than has the hydrogen with which it is combined—the oxygen will combine with this "reducing" element, and set the hydrogen free. In the manufacture of water gas, the well-known affinity of heated carbon (coal or coke) for oxygen is utilized in thus resolving steam; the hydrogen being liberated, and the oxygen (O) combining with the carbon (C) to form carbonic oxide (CO).

Chemical Basis.—The chemical reactions, according to which this decomposition takes place, may be written thus—

Water. Carbon. Hydrogen. Carbonic Acid.
$$2\,H_2O + C = 2\,H_2 + CO_2$$

In the presence of an excess of carbon, however, the carbonic oxide saturates itself by taking up another carbon atom, thus—

Carbonic Acid. Carbon. Carbonic Oxide.
$$CO_2 + C = 2\,CO$$

making the finished product—

$$2\,H_2 + 2\,CO$$

"*Theoretical*" *Water Gas.*—This finished product (hydrogen and carbonic oxide in equal volumes) is practically odourless and non-luminous, burning with an intensely hot flame. It may be called "theoretical" water gas, for in practical working the reduction of carbonic acid (CO_2) to carbonic oxide (CO) is never quite perfect; the unpurified gas usually containing about 3 per cent. of the unreduced acid, to be extracted (as in the case of coal gas) by lime purification.

"*Carburetted*" *Water Gas.*—In the process which we shall presently describe, water gas is generated by passing a current of steam through a deep bed of incandescent coke; and as it issues from the generator into the adjoining carburettor, this hot gas is enriched to any desired point, by means of crude oil or cheaper distillates. Hence the name *carburetted* water gas; *the hydrocarbons thus derived from the oil imparting to the gas an odour as pungent and characteristic as that of coal gas.* The italics are intentional, as there is considerable popular misunderstanding on this point.

Nature of the Process.—It is manifest that, unless we in some way replenish the heat as fast as it is extracted from the generator, the fire will be gradually extinguished, and the generation of gas cease. There are two ways of supplying this lost heat: First, by external combustion—that is, by independent firing beneath or around the vessel containing the decomposing fuel-bed. Of this method, which at one time received much attention, there are no examples now extant. Secondly, by intermittent internal combustion, as in the process about to be described; the "runs" (or periods of gas making) and "blows" (or periods of air-blasting)—when the production of gas is intermitted, in order to recuperate the temperatures within the apparatus—succeeding each other at regular intervals. Now when we admit air to the bottom of a heated fuel-bed of considerable depth, it is a "producer" gas—not the product of finished combustion—that escapes from the top, the energy of this gas varying inversely with the power of the blast and directly with the temperature and depth of the fuel-bed; and the distinguishing economic feature of the process under discussion consists in utilizing the energy of these blast gases issuing from the generator during the "blow" for subsequently gasifying the enriching oil in the presence of the hot water gas concurrently produced.

Description of Apparatus.

The following is a description of the apparatus in its usual sequences—viz., generator, carburettor, superheater, oil-heater, washer or seal, scrubber, and condenser (the last two being situated outside the building).*

Construction of Vessels.—The generator, carburettor, and superheater are cylindrical steel shells, thickly lined with special fire-blocks, between which and the metal are annular spaces packed with non-conducting material, reducing the radiation to such a minimum that the hand may be held upon the metal casings. The generator is usually supported on short columns, leaving cartage room under the hopper-shaped ashpit. The grate, controlled by the several cleaning-doors, is located slightly above the ashpit; and the fire is charged with coke through the door in the extreme top. The generator is connected, both above and below the fuel-bed, with the top of the carburettor, the bottom of which leads laterally into the adjoining superheater. The carburettor and superheater—often referred to as the "fixing chambers"—are filled with checker-work, designed and spaced as determined by long experience, and affording such an enormous heating surface that the most difficult and persistent vapours may be permanently gasified at the low temperatures necessary to the highest illuminating effect. At the top of the superheater is a valve-controlled outlet for the blast products. During the "run," or period of gas making, this outlet is closed; and the carburetted gas escapes through the side take-off pipe into the small vertical casing of the oil-heater, and thence, forcing the seal in the washer, through the scrubber and condenser to the relief-holder.

Oil-Feed and Relative Observations.—The oil-heater is a simple and practical arrangement for pre-heating the oil on its way to the carburettor by means of the hot gas escaping from the superheater; and a steam-pump connected with the storage-tanks delivers oil at a constant and moderate pressure through a meter and this heater, to a centrifugal distributor in the top of the carburettor. Thus the heated enriching oil is introduced at right angles to the cross section of the carburettor, in an atomized spray that uniformally covers the sectional area; and there is no way for the light vapours—frequently the most difficult to permanently gasify—to short-circuit the route, the whole necessarily traversing the great combined length of both carburettor and superheater.

This is worth noting, since it was the confusion of the principle of fractional distillation with that of permanent gasification, that chiefly retarded the perfection of carburetted water-gas apparatus; and to this day, there is something in the idea of fractionation that fascinates most immature designers. Of the many types of apparatus that during the past several years have attempted to compete with the "double superheater," I do not recall one that has not offered as its distinctive advantage the fractional treatment of the oil, generally by introducing it at an intermediate point in the height of the superheater, enabling the lighter vapours to quickly escape from the top, while the heavier unvapourized portion was supposed to fall back against the current of the water gas, thus traversing the entire height of the chamber. The plausibility of the scheme lies in the inference that the lighter vapours are easily gasifiable, and will be largely converted into lampblack if exposed to considerable fixing area; and its unsoundness is most practically illustrated by the fact that, while the Russian "Solar Distillate" most largely used in the manufacture of carburetted water gas has a flashing-point over 200 Fahr., the small quantity of ungasifiable oil-tar recovered from it will flash at any atmospheric temperature.

It may be taken as the first requisite of the economical gasification of oil that it shall be exposed to a large surface at a uniformally low temperature. Furthermore, this surface should consist of length in the direction the gas travels rather than cross section, as the oil vapours should never be allowed to approach a condition of rest in contact with the heated surface in the fixing chambers.

Operating-Floor, &c.—An elevated operating-floor, flush with the generator charging-door, affords the best means of manipulating the plant; consequently all levers, valves, and appurtenances requiring attention are assembled at this level. It is here that the gas maker is stationed. The air-ducts, situated below the ground-floor, and leading from the blower to the generator, carburettor, and superheater respectively, are controlled by valves regulated from the operating-floor. The battery-gauge, indicating the pressure, at the various stages of the process, apprises the gas maker of the working conditions throughout the apparatus.

Method of Operating.

Starting Up.—A fire is started in the generator, which is then deeply charged with coke and opened to the blast. The air enters in large volume below the grate, and quickly kindles the fuel; while the hot products resulting from the partial combustion pass forward through the carburettor and superheater, and, after parting with their sensible heat, escape into the stack. As soon as the generator gases have sufficiently warmed the checker-work, supplies of secondary air are admitted to the top of the carburettor and the bottom of the superheater respectively, and the combustion regulated so as to give the requisite temperatures in the two vessels simultaneously.

The "Run."—The generator fire being in proper condition, and the carburettor and superheater at the desired temperatures, the apparatus is ready for gas making. The blasts are shut off one by one, beginning with that of the superheater; the stack-valve is closed; and steam is admitted under (or over) the fuel-bed, and, having traversed it, passes as water gas into the top of the carburettor. At this point, the oil is introduced as already described; and, encountering the heated checker-work, it is vaporized and ultimately gasified in the beneficial presence of the hot water gas. This process continues without intermission until the temperature of the fire and checker-work are sufficiently reduced.

The "Blow."—The oil is then shut off, and next the steam; and the stack-valve being opened, the blasts are again admitted, and the energy of the fire and the checker-work recuperated as first described.

General Routine.—The generator has to be supplied with fuel at intervals of from 45 to 60 minutes, and cleaned usually once during each shift. With intermissions of firing and cleaning, the process consists solely of the operations described, alternating at regular intervals, as observed by the clock; and it is so simple in practice that its routine may be efficiently acquired by any ordinary workman in a few days.

Impurities.—The gas passes from the seal through the scrubbers and condensers, and is subsequently deprived of its carbonic acid and treated for its slight sulphur impurities in the manner common to coal gas.

Feature of Note.—A feature of note in the process, is the reversing or "alternative" method of gas production in the generator. If steam be always admitted to the bottom of the fuel-bed, the heavy duty of its decomposition is too largely performed by the lower portion of the fire, which becomes in time inactive and deadened beyond the point of ignition. The succeeding air-blast, therefore, instead of rekindling it, chills this lower stratum almost to the temperature of the outside atmosphere; and when steam is again admitted, it condenses freely in the cold cinder. Frequent removal of this condensing stratum is both laborious and wasteful. Periodically reversing the current of steam in the generator, comprehensively corrects the above evil by distributing the duty of the fuel-bed throughout its entire bulk. As this reversal is completely effected in one movement, possibility of confusion or mistake is precluded.

* A drawing showing the arrangement of the plant was given in the "Journal" for May 15, 1894 (p. 909).—Ed. J. G. L.

The Chemical and Physical Properties of carburetted water gas may be illustrated in the following table, based upon determinations by Messrs. Shepard, Bruckner, and Schimmel and Dr. Gideon Moore, which confirms what we have previously noted regarding its qualitative similarity to coal gas, while serving the more useful purpose of specifically differentiating the two gases:—

	Double Superheater Apparatus in 1895.		Water Gas in 1885.		Heidelburg Coal Gas.
CO_2	2·20	0·60	0·14	0·30	3·01
O	..	0·40	0·06	0·01	0·65
C_2H_4	2·80	8·00	11·29	12·80	2·55
C_3H_6	8·00	6·00	..	..	1·21
C_6H_6	2·00	2·00	1·53	2·63	1·33
CO	24·20	23·00	28·26	23·58	8·88
CH_4	17·83	20·80	18·88	20·95	34·02
H	37·95	34·00	37·20	35·88	46·20
N	5·02	5·20	2·64	3·85	2·15
	100·00	100·00	100·00	100·00	100·00
Approximate candle power	28	30	22	25	14
Specific gravity (calculated)	·6425	·6483	·5825	·6057	·4580
Flame temperature	5275·6° F.	5190° F.	5311° F.	5281° F.	5203° F.
Heat-units * per cubic foot of gas—					
Calculated	704·70	735·90	650·00	689·00	642·00
Observed	708·90	736·70	—	—	—
Cubic feet of air required for perfect combustion—					
Per cubic foot of gas	6·12	6·50	5·52	6·20	5·63
Per pound of sperm	63·70	63·20	73·20	69·60	117·30
Cubic feet of resultant products, including aqueous vapour—					
Per cubic foot of gas	6·92	7·60	6·20	6·90	6·37
Per pound of sperm	72·10	73·90	82·20	77·50	132·70

* For equal candle powers, the heating effect of carburetted water gas is somewhat (about 5 per cent.) less than that of coal gas.

Character of Flame.—There are two features of the highest importance that are not exemplified in the above table, the first being the character of the flame. Taking carburetted water gas and coal gas of equal candle powers, it will be noted that the former burns with a smaller and much more brilliant flame; the intense incandescence to which the carbon particles are exposed leading to greatly improved combustion. This feature is farther reaching in its effect than may be at first supposed, for the great objection to lighting by gas, which is the ruling consideration in almost every instance of its displacement by electric light, is the inevitable destruction of ceiling and other decorations owing to imperfect combustion at the burner. The writer speaks from absolute as well as common experience when saying that the 30-candle power carburetted water gas of New York and other American cities is used, in ordinary flat-flame burners, with a freedom from soot and noxious products unapproached in towns supplied with ordinary coal gas.

Carbonic Oxide.—This striking advantage is now conceded to be due to the greater percentage of carbonic oxide in the former gas, which, to use Dr. Moore's words, by "its density and high flame temperature greatly promotes the illuminating effect, and retards waste." The increased proportion of this same gas, be it noted, was once decried as a menace to health and life, and formed the basis of the Massachusetts legislation already mentioned. I did not mention, however, that among the evidence leading to its repeal was a petition signed by 223 Boston physicians, in their joint capacity as gas consumers and physiological experts, concluding with the statement, "It is no more dangerous to health and life than coal gas; and there is no just ground, as far as health and life are concerned, to prohibit its manufacture," over the distinguished names of Professor C. F. Chandler, Ph.D., M.D., President of the Health Department of New York, and Mr. P. W. Bedford, Professor of Pharmacy in the College of Pharmacy of New York.

In the same exhibit appeared evidence from Professor Walther Hempel, of Dresden; Professor Adolphe Wurtz, of Paris; Dr. Edward Frankland, of London; Professor T. Sterry Hunt, of Montreal; Professors H. H. Croft and W. H. Pike, of Toronto; Regis Chauvenet and Brother, manufacturing chemists, St. Louis; Dr. Joseph Jones, President of the Board of Health of Louisiana; Dr. P. B. Wilson and Professor W. E. A. Aiken, of Baltimore; Professor H. B. Nason, of the Troy Polytechnic Institute; Professors R. S. Hall and Henry Wurtz, of New York; Dr. E. G. Love, Official Gas Examiner of New York; Professor Ira Remsen, of the Johns Hopkins University; Professor Edward S. Wood, of the Harvard University; Professor Benjamin Silliman, of Yale College; and Dr. Henry Morton, President of the Stevens Institute of Technology. Also letters from the Mayors of Jersey City, Louisville, Savannah, Albany, St. Louis, and Harrisburg. Though this is very ancient history, doubtless these same gentlemen derive modern satisfaction from their present knowledge that, owing to the formerly despised ingredient, the displacement of coal gas by carburetted water gas is accompanied by healthful benefit.

Sulphur.—The other important fact not shown in the table is that carburetted water gas contains scarcely one-fourth of the sulphur present in coal gas; and this being almost exclusively in the form of sulphuretted hydrogen, oxide of iron purification alone reduces the sulphur below 5 grains per 100 cubic feet.

Naphthalene.—There is yet another physical property of carburetted water gas that is worth bearing in mind. It is that, when mixed with coal gas, it acts as a solvent vehicle for naphthalene, and, except in rare instances, entirely prevents its precipitation from the latter gas.

Enrichment of Coal Gas.

The auxiliary manufacture of carburetted water gas affords a perfect and the only known means of combining production with enrichment in proportions that may be instantly adjusted to suit immediate requirements. If, owing to intense frost, change in the character of the coal, or other cause, the quality of the coal gas cannot be maintained, a change in the valve controlling the oil supplied to the carburettor instantly compensates for the deficiency. Nothing else is necessary, and no routine is altered. If, on the other hand, a sudden demand arises for more gas, a reserve section is in full operation within three hours; and a change in the oil-valve now reduces the quality in correspondence with the increased bulk. The quantity and quality of the commercial gas leaving the works is thus absolutely maintained without interference with the normal operation of the coal-gas benches; naturally resulting in decreased working expenses and retort-house repairs.

But the most convincing reason why carburetted water gas is at its best when one of its functions is the enrichment of lean coal gas is that the higher its quality, within practical limits, the cheaper is its cost per candle. Suppose, for instance, we are making carburetted water gas of 18-candle power at 1s. per 1000 cubic feet with 2⅛ gallons of oil costing 3d. per gallon, by simply an additional gallon of oil, or 25 per cent. of the total cost, the quality of the gas is raised to 25 candles, or 40 per cent.; and the original 1000 cubic feet is increased to about 1100 feet by the bulk derived from the extra gallon of oil. Hence you will be prepared for the statement that in many localities enrichment by carburetted water gas costs *nil*, since the enriching gas, though of higher candle power, costs less per 1000 cubic feet than the lean coal gas. This contrasts strikingly with the waning method of enriching coal gas by means of cannel, whereby the cost of *each* candle of enrichment above the normal quality yielded by the coal, frequently reaches 2d. per 1000 cubic feet. Such a practice has inevitably resulted in a disposition among many gas manufacturers to consider the present standards of illuminating quality onerous.

Collateral Advantages.

The collateral advantages of carburetted water gas as an auxiliary to coal gas manufacture are now so well understood, and have been so happily described by the Engineer to the Belfast Corporation gas undertaking (Mr. James Stelfox) in his paper "A First Season's Experience of Carburetted Water Gas,"* that I need only record the various headings. I shall place them as follows:—

1.—Control of the coke market by providing a demand on the works for the hot coke issuing from the retorts, besides checking the production of coke in proportion to the quantity of coal gas displaced.
2.—The small ground space occupied; the saving effected in the necessary limits of the coke-yard usually sufficing for the entire generating plant.
3.—The emergency quality, owing to the immediate availability, without injury, of reserve plant, as contrasted with the several days needed to bring coal-gas benches into action, and the ensuing expensive repairs.
4.—Saving in first cost of plant.
5.—Instant control of candle power.
6.—Approximate independence of crises in the coal supply; the surplus coke from 1000 cubic feet of coal gas producing 3000 cubic feet of carburetted water gas.
7.—Practical independence of labour; the continual work of two gas makers, a fireman, and several common labourers being sufficient for a plant generating two million cubic feet daily.
8.—Prevention of naphthalene deposits.
9.—Action of the *diluent* gases in promoting perfect combustion at the burner.

Commercial Advantages.

Having heard an unbroken record of the material advantages of carburetted water gas, you doubtless anticipate the claim that it is, *per se*, cheaper to manufacture than coal gas. On the contrary, I have never yet advised its exclusive substitution for coal gas at any point in the United Kingdom; and even in America, when in charge of the lighting interests of Kansas City, I claimed and found economy in making nearly one-half coal gas. In short, whether or not carburetted water gas, as such, be more economical than coal gas, must be determined by individual comparison—it is a question of locality rather than process. As an auxiliary to coal gas manufacture, however, there can be no doubt of its universal applicability throughout the United Kingdom; and as a forceful example, I may describe the general situation at Belfast.

Before the installation of carburetted water-gas plant, the cost of manufacturing coal gas was 13·35d. per 1000 cubic feet; and the greatest year's profit ever yielded by the undertaking

* See "Journal," Vol. LXIII., p. 1225.

was £23,000. During its first year, making but 20 per cent. of carburetted water gas, the profit rose to £34,000, though according to the general books, the new gas cost 13·324d. per 1000 feet, showing no appreciable saving. This anomaly is easily explained, in view of what we have learned as to the "collateral" advantages of carburetted water gas—especially when used as an enricher. In the first place, the immediate result of the starting of the process was the abolition of cannel enrichment. This, while relieving the coal gas of an expensive burden, added somewhat to the cost of water gas by necessitating an average of 24-candle power for the year. In the next place, as soon as the decreased production of coke had enabled the large accumulations to be disposed of, its price was advanced 2s. 6d. per ton, the whole of the revenue going to the credit of coal gas; whereas the water gas—if required to pay this enhanced price—would, of course, be injuriously affected in the accounts. Thirdly, no retorts were fired except those kept in continuous working throughout the season; the water-gas plant being utilized to meet all fluctuations in output as well as the heavy mid-winter consumption. Thus coal gas again benefited by a material saving in fuel, labour, and retort-house repairs, at the expense of the intermittent working of the water-gas plant. Of the second year—just ended—I have no information, other than that the net profit exceeded £55,000; resulting in a reduction of 3d. per 1000 cubic feet in the price of gas.

Roughly speaking, therefore, it appears that the manufacture of carburetted water gas has doubled the profits of the Belfast undertaking, though an analysis of the general accounts shows the present cost of coal gas, per 1000 cubic feet, to be far less than that of water gas. In other words, the enormous saving has been in the reflex action of carburetted water gas upon coal gas manufacture. The appended estimate serves to illustrate the various items that enter into the cost of manufacturing carburetted water gas of 24-candle power:—

Oil, 3½ gallons at 3d.	10·500d.
Coke (including boiler fuel), 40 lbs., at 12s. per ton	2·500
Labour, total employed	1·500
Purifying materials	0·500
Repairs and maintenance	0·500
Water (if not re-circulated)	0·200
Management and sundries	0·300
	16·000d.
Less value of oil tar recovered	0·500
Total cost per 1000 cubic feet made	15·500d.
Plus 5 per cent. loss in distribution	0·780
Total cost per 1000 cubic feet sold	16·280d.
Cost per pound of sperm sold	0·198

It will be noted that the figure of total cost is fairly liberal, as compared with the actual cost of gas of the same quality at Belfast.

The following figures, averaged from "Field's Analysis" for the six years 1890-95, give the manufacturing costs of the London and of the Suburban Companies per 1000 cubic feet of coal gas, with the sperm equivalents:—

	Candle Power.	Cost per 1000 Cub. Ft.	Cost per Pound of Sperm.
London	16	15·49d.*	0·274d.
Suburban	15	18·25	0·342

Thermal Influence of Water.

Much has been written encouraging the popular misconception—inaugurated by the misleading tendency of the name itself—that the process derives some thermal benefit from the use of water; notwithstanding the fact that water is a product of finished combustion—being the saturated staple compound of hydrogen and oxygen. Whenever and wherever such combination is effected, 61,500 units of heat are evolved per pound of hydrogen; and the resultant product can be decomposed only by the absorption of an exact thermal equivalent. Further, the combustion of the hydrogen present in water gas (uncarburetted), yields precisely the quantity of aqueous vapour originally decomposed in the production of the gas; and, assuming this water to enter and leave the system at the same temperature, its thermal influence must be *nil*. In other words, we can neither create nor destroy energy or matter.

Looking behind the scenes, therefore, we find that water is merely a transporting agent, providing a means by which the energy of solid carbon can be distributed in gaseous form, and that it is in reality the carbon consumed in the fuel-bed that is the true source of all the heat developed. A continuation of this argument will show the worthlessness of schemes for making the generating process continuous, by superheating the steam before its admission to the fuel-bed. Even when superheated to 1500° Fahr., the steam carries scarcely 9000 additional heat units, or but 2½ per cent. of the energy absorbed in the manufacture of the carburetted product.

Thermal Efficiency.

It would be too great an imposition upon your patience to do more than refer you to the author's paper on "The Practical Efficiency of a Carburetted Water-Gas Setting,"† in which it is demonstrated that the apparatus—even in 1890—utilized 61 per cent. of the total carbon consumed, while its ultimate efficiency, taking the energy of the oil also into consideration, was 81 per cent.; placing it, to say the least, upon a par with any modern type of heat engine.

* This figure is somewhat benefited by the carburetted water gas now made by The Gaslight and Coke Company; representing, however, but a trifling proportion of the total London output.

† See "Journal," Vol. LVI., p 1338.

GAS CONTROL FROM METER TO BURNER.

Lecture by Mr. D. Macfie.

Under the auspices of the District Council for Edinburgh and the East of Scotland of the National Registration of Plumbers, Mr. D. Macfie (of Messrs. James Milne and Son, Limited) delivered a lecture on the above subject last Thursday, in Queen Street Hall, Edinburgh. The President of the Council (Mr. A. Allan) was in the chair; and there was a large attendance.

Mr. Macfie said that in this age of sanitary science, when plumbing is looked upon as "a handmaid to health," there was some danger of gas-fitting—a modern and always subordinate branch of their trade—receiving less attention than its importance demanded. At the outset, they noted an essential difference between the official control of the public supplies of gas and water. Water Companies and Trusts exercised control not merely up to the service cock, but within doors, from garret to basement; and they reserved their right to inspect every fitting through which the water took its course. Gas Companies or Commissioners did not, on the other hand, state any particular concern with the indoor condition of pipes or fittings, beyond fixing the meter, from which point the consumer might waste or utilize the gas as he pleased. The difference was easily accounted for. Water was supplied under assessment; while gas was duly measured, and must be paid for accordingly. Waste of water fell on the Water Trust; while waste of gas was profitable to the seller, who was under no obligation to educate the buyer of gas. In the use of gas, therefore, tradesmen and their customers had a field for the exercise of economy, such as they had not in connection with water supply. The public needed enlightenment in the proper use of gas; and it was for gas-fitters to study the problem, and to educate their clients on the subject. If they did not do so, the time might come (and in some towns it had already come) when the fitting up of gas-pipes, the supply of gas-stoves, and the gratis distribution of gas-burners, would be undertaken by the sellers of gas.

The quality of gas in Scotland differed from that used in England and Ireland. There were Scotch Companies who still supplied gas of from 28 to 30 candle power. The larger towns had lowered the quality; and to-day Scotch gas varied from 20 to 30 candle power. In Edinburgh, it would not be uncharitable to assume that it averaged 25 candles. Except in Scotland, the illuminating power of gas ranged from 14 to 20 candles; but it might be said that, as a rule, Edinburgh consumers did not develop the lighting power of the gas supplied to them so well as did their friends in the South. The reason was not far to seek. The English consumer had never known any higher quality; his gas was cheaper per 1000 cubic feet; and he had all along used burners to fairly well develop the lighting value of the gas which he bought. On the other hand, the Edinburgh gas consumer was brought up with gas of from 28 to 30 candle power; and at one time smaller burners served his purpose. He had not yet been brought face to face with the fact that the conditions were changed, and that a burner which might have been fairly satisfactory with a 30-candle power gas, could not profitably be used with gas of 5-candle power less. It was not necessary either to uphold or condemn the policy pursued in Edinburgh, of lowering the quality, so soon as the Corporation took in hand the business of gas supply. But when this step was resolved upon, it was the duty of the Gas Commissioners to intimate that (for reasons of policy or expediency), it had been found wise or necessary to lower the illuminating quality of the gas, and that to maintain equal light, consumers should replace every burner in use, by a burner at least one size larger. An intimation to this effect would have saved much grumbling in the public interest.

He need not discuss the merits of high *versus* low illuminating power gas, though it was a subject on which much could be said; but the weight of opinion, or perhaps the force of circumstances, was tending to lower rather than to increase the lighting quality, and the causes which were bringing this about were: The enhanced price of cannel coal; the increasing use of gas for heating and cooking; and the introduction of the incandescent gas-burner. For this latter purpose, 15-candle power gas was to be preferred to that of 25-candle power. Assuming that 25-candle power gas was what they had to deal with in Edinburgh, the question was how to develop this power in actual use. It could only be done by understanding the conditions of gas supply as it affected the various forms of burners, in developing or enhancing the lighting power up to, or beyond, the nominal value.

The meter was the proper starting point for the subject in hand; but, in advance, some reference might be made to the outdoor conditions which regulated volume and pressure—the two main factors in the problem under review. They need hardly be reminded that, as to pressure, water and gas differed essentially. It was an axiom that water could not rise above

its own level; and the greater the head of water the greater the pressure. Gas, being lighter than the atmosphere, was not subject to this law; and for this reason the pressure of gas increased as it rose from its source, by a fixed gradation of one-tenth of an inch for each 10 feet in its ascent. But, as practical men, they would realize that even such fixed laws as that "water would rise to its own level," and that "gas pressure increased according to altitude," were subject to important modifications when mains were too small for the draught made upon them, and where service-pipes were fitted without reference to the duty they had to perform. Variation in pressure was not wholly a question of levels; for it was necessary to vary the initial pressure at the gas-works according to the draught which might be made at different hours and seasons, and to compensate for the inequalities in the size of street-mains. It would thus be seen that there could not be uniformity of pressure throughout, even if the gas were to leave the works at a uniform pressure. This would be possible only in a perfectly flat country, where the mains were so amply sufficient, and the demand so uniformly steady, as to permit of unvarying control. But these ideal conditions nowhere existed. This initial difficulty was greater in such a district as theirs, where there was so large a variety of levels; although attempts were made to equalize pressure by the use of district governors, which answered to the pressure changes at the gas-works. The net result of these conflicting elements was that there could not be uniformity of pressure in any two districts of the city. But it was certain that the problem was not how to *increase* the pressure, as was often supposed, but rather how to regulate or control it so that, at the point of issue, the gas would be delivered in sufficient volume, and at the pressure best suited, for the purpose in view.

To assist in this, they required a gas pressure-gauge, which was an essential gas-fitters' tool. No kit, or at least no shop, should be without one. With flat-flame or argand burners, the best results were obtained at a pressure of 5-10ths at the point of ignition, which low pressure permitted of proper combustion, but the flame would appear sluggish, and, when much disturbed, would give off smoke. Any increase of pressure resulted in a whiter, but less luminous, flame—an evidence that the carbon particles were being forced through at too great velocity. This prevented efficient combustion, while giving off greater heat, and rendering the atmosphere stuffy and unhealthy in proportion to the increase of pressure. If pressure were unvarying, even if high, it would be possible to recommend the so-called "regulator" burners, which could be made to consume an exact quantity of gas per hour at any given pressure. But such burners, if sent out and used promiscuously, were not regulators in any efficient sense, but merely checks to flaring and hissing. They did not ensure that only a given quantity of gas would pass the burner, irrespective of variations in pressure. All of the so-called "regulator" burners required governing quite as much as simple burner tips, though the controlling power was not called for so early in the range of pressure. The regulating burner was, in fact, an ordinary burner stuffed with so many plies of muslin, which merely acted on the flow of gas, and did not ensure that only a given quantity would pass the burner at varying pressures. Such a burner might, for example, consume 3 cubic feet of gas at 5-10ths pressure; and at 3-10ths, it might consume as much as 6 cubic feet per hour, and with nothing like a proportional increase of light per foot of gas consumed. It had to be borne in mind that, even under the most favourable conditions, the full lighting value per cubic foot could not be developed in a flame which consumed less than 5 cubic feet per hour.

It might not be out of place to suggest that with Edinburgh gas of 25-candle power, the use of all burners smaller than No. 4 should be confined to bath-rooms, passages, and cellars, where light was only wanted occasionally, and not much of it. And yet the Edinburgh lighting authorities—alongside of a worthy, if extravagant, zeal for the luxury of street lighting by high-power electric lamps—were content to continue the lighting of their less favoured streets with burners set to consume about 2 cubic feet per hour, in lamp posts over 9 feet high, at a distance of from 20 to 30 yards apart. Before the Corporation took over the gas undertaking, there was some excuse for restricting the output, seeing that the Gas Companies had to make a profit out of the gas supplied for street lighting; but even then the poorly lit streets of the city were a by-word and a reproach. When the Corporation became the proprietors of the gas undertaking, it might have been supposed that larger burners would be adopted, and that at least a 3 cubic feet flame would be substituted. But when the candle power of the gas was lowered, larger burners were necessary to develop the former equivalent in lighting value. The existence of streets brilliantly lit by electricity, alongside of streets in the same city lit with gas-burners giving less than 10-candle power illumination (the sources of supply in both cases belonging to the citizens), was indefensible; and its continuation could only be the result of indifference on the part of the public or its servants. What the public had a right to expect was that every street-lamp in the city should be supplied with a governor burner, developing something like 25-candle power illumination; and this could be attained by an additional gas consumption of 3 cubic feet for each lamp per hour, which, for 1000 lamps, would amount to 3000 cubic feet, costing the Corporation not more than 7s. 6d. per hour additional for each 1000 lamps. The present burners could be altered to meet the case for a few pence each; and this would serve until a Convener of Lighting was brought to see that the old lamp globes—made for use with the rat-tail jet, and to be lit with the old lamp and ladder—were not designed for lighting with rods, and were, in fact, robbed of any virtue they had, by the cutting of a hole for lighting, which increased risk of breakage, and served as an injector for every wind that blew, and prevented the steady burning of even one poor 2-feet flame. He knew of nothing more pathetic as an exhibition of gas lighting than to note the fantastic behaviour of an Edinburgh street-lamp burner during a high wind, as the draught played through the torch hole, and swirled within the globe.

The advantage of low-pressure flames might be seen at night in the four burners displayed before them. Each of these burners had been carefully adjusted to pass the same volume of gas—viz., 5 cubic feet per hour; the difference being one of pressure only. At the point of issue, the pressure was, in the first instance, 3-10ths; in the second, 8-10ths; in the third, 13-10ths; and in the fourth, 17-10ths. It required no photometer to indicate that the gain in lighting power was increased as the pressure was lowered; and the luminous flame in the burner consuming 5 cubic feet at 3-10ths illustrated the highest possible duty attainable in a flat-flame burner, though the pressure was too low for actual use. On the other hand, the burner consuming 5 cubic feet at 17-10ths might be held to fairly represent the average duty of the burners generally in use throughout the city.

It was thus manifest that rich gas, improperly consumed, might be of less value than poorer gas properly utilized. Atmospheric or bunsen flames gave best results at a pressure of 10-10ths or one inch pressure. This included all atmospheric gas-stoves, gas-engines, and also incandescent gas-burners. Any less pressure was liable to cause lighting-back; and in the case of the Welsbach burner, low pressure tended to blacken the mantles. These were conditions which should rule in front of the meter; and proper results might be secured or not, according to the details of piping, the selection of burners, and the regulation of volume and pressure.

They might now follow the gas supply within doors, from meter to burner. With the gas service, they had practically no concern; and since meter-rents had been wisely abolished in Edinburgh, the measuring apparatus was outside their control. But it might be their duty to advise as to meter capacity; and in some towns gas-meters were still included in the gas-fitter's contract. It was of the first importance that the meter should be of sufficient capacity for the free delivery of the maximum quantity of gas likely to be required. It was not unusual in Scotland to find meters doing four or five times their nominal duty; and it was no wonder if, in such cases, consumers complained of poor light. But the pity was that they were often content to grumble, and declined to have a larger meter put in, lest the bigger one should increase their gas bills. Of course, if more gas were used, it must be paid for; but one might as well object to a big pair of scales as more likely to be unjust than a lesser pair. It had been usual in Scotland, with their richer gas and smaller burners, to consider a 5-light meter sufficient for ten burners; and a 10-light meter sufficient for 20 burners; and so on. This was the safe margin of duty under average conditions of pressure. Any meter, therefore, which had a much greater draught on it than two burners for each "light" must be overdriven, and could not be properly governed. If allowance for gas-stoves had to be made, each heating-stove should count as four burners; and gas cookers should be taken as six or eight burners, according to size. The diameter of the meter connections fixed the size of the rising main, which should be of the same diameter, while the meter-cock should have the largest possible clear-way.

Starting from the meter with a full sized pipe, there was room for difference as to its material. In Scotland, there was a general preference for block-tin pipe, which was indeed first made in Edinburgh and introduced by Mr. James Milne, who in the earlier days of gas-fitting used copper pipes, and only discarded them when it was found that the passage of gas through the copper set up an injurious chemical action. As a medium for passing gas, nothing could surpass that pure metal (with its clear bore and smooth surface) when well and truly laid. But it had one drawback, in its attraction for joiners' nails, and the liability of picture nails to find it. Even with these defects, it would hardly have gone out of favour but for the introduction of what was at first called "patent composition pipe." This, with its superficial coating of tin, had largely supplanted block-tin pipe; and by its leaden softness, and its liability to festoon between the hold-fasts, and to gather moisture, it had done more to discourage the use of metal pipes than anything else. It was not to be wondered at if architects and engineers had sought relief in wrought-iron piping, which had the advantage in rigidity and resistance. But when all was said that could be said in its favour, one might urge a return to block-tin piping for indoor use, at all events from one inch downwards. The making of wood casing for electric wire and cable was already an industry; and there was nothing to prevent its being used for tin tube, from one inch downwards, and used with advantage. He did not go into details, but threw out the suggestion; and, by way of illustration, he had prepared a few fittings showing the application of wood casing for gas-fittings of

tin tube, which would apply equally to the leading of iron tube in front of plastered walls.

Suppose a mansion-house of three floors was to be fitted with (say) 40 burners, and, in addition, two gas-fires and a cooking-stove. Of the 40 burners, assume that three-fourths would be in use at one time. Allow for 30 burners consuming, on an average, 4 cubic feet of gas per hour, of 25-candle power, equal to 120 cubic feet. Take each gas-fire at 18 cubic feet per hour; and the cooking-stove at 32 cubic feet. There would then be a delivery in all, of 190 cubic feet per hour. A gas-meter would pass 6 cubic feet per light at 5-10ths pressure; and so a 30-light meter would give, even at this low pressure, sufficient volume, which would be increased if the gas were delivered at 10-10ths pressure. A 30-light meter was supplied with connections of 1¼-inch bore, and the rising main should correspond in diameter, which, however, might be reduced on the second or the way to the third floor. Long runs of small-sized pipes should be avoided; and ¼-inch pipes should never be used except to supply single burners at no greater distance than 6 feet from the branch supply. For the two gas-fires and the cooking-stove a separate branch should be led from the rising main near the meter, of ¾-inch bore. If this were done, it might be reduced to ½-inch on its way to the cooking-stove; while each gas-fire should be fed with ½-inch pipes, taken off the ¾-inch branch.

Piping of sufficient capacity being in position, the question of regulation arose; and they might assume that the pressure varied from 5-10ths in the morning to 30-10ths in the evening. Even the lowest pressure named was wasteful either for cooking, lighting, or heating. The course open to them at this point was to fit a pressure governor on the stove supply. But they had still to deal with the lighting section of the supposed installation. If they fixed a second mercurial governor on the rising main, and adjusted it to 5-10ths, they might proceed to fix non-regulator enamel-tip brass jets throughout—taking care to select the size of jet according to the illumination wanted. But, of course, they should have 6-10ths on the first floor, and 7-10ths on the second floor, which slight increase of pressure was of small moment. But a new factor in lighting had in these days to be kept in view. The incandescent burner was sent out adjusted to consume its proper volume at 10-10ths pressure. This suggested that one meter governor would serve both purposes; and hence they had the alternative of using one 1¼-inch governor to control both the lighting and heating. But when adjusted at 10-10ths pressure for stoves and incandescent burners, their non-regulating burners would be wasting gas at the increased pressure. This, again, could be met by so-called "regulator" burners, made specially to consume their regulated volume at 10-10ths pressure, but not the stock article which was, roughly speaking, stuffed to check a 30-10ths pressure.

Leaving these ideal conditions, let them see what was found in everyday use, and what was the required treatment. In the early days of gas supply in Edinburgh, the quality of gas was no doubt quite 30-candle power; and the burners then used would not, on an average, consume more than 2 to 3 cubic feet per hour. Thus the pipes which might be sufficient in the old times were not adapted to the changed conditions. Supply pipes were often led from the meter forward with no regard to the duty required at the various lighting points. As a general rule, there was an excess of pressure at the meter outlet, along with a deficiency throughout in the pipe capacity, which practically prevented proper regulation of pressure, or equal distribution of volume.

Compared with the specification already given in a supposed case, let them compare the actual state of things in a typical Edinburgh West-End mansion. The house was of six floors, and was fitted with 130 burners, with the addition of a gas heating stove and a small cooker. Reducing their former proportion, let them assume that the pipe supply should be sufficient for only one-half of the lights, provision should be made for 65 burners at 4 cubic feet each—equal to 260 feet; for a gas-fire at 16 cubic feet; and for a cooker at 30 feet—a total delivery of 306 cubic feet per hour. For this quantity a 40-light meter at least would be required. Instead of this a 20-light meter had been fixed, with 1¼-inch rising main; and (as if there were an excess of gas) a mercurial meter governor had been fitted and adjusted at 12-10ths. The limit of delivery by a meter at this pressure was about 200 cubic feet; so that, at no time could there be, throughout the house, more gas than sufficient to supply 50 four-feet burners—about one-third of the number fitted. Yet, again, the burners in use were the ordinary "regulator" burners, checked by stuffing to resist 5-10ths to 30-10ths pressure—still further complicating the conditions. The only really efficient gas burning appliance was a heating-stove on the sixth floor, which, being at the highest draw-off point, resulted in a pressure of 18-10ths because of its height above the governor. It was hardly possible to conceive a less satisfactory condition of things; yet it was not uncommon.

Now the logic in such a case as that was to condemn the whole thing, "stock, lock, and barrel;" but this would involve as much disturbance as, and hardly less expense than, would pay for an installation of the electric light. Short of absolute condemnation, the practical point was what could be done to help matters in such-like circumstances. First of all, it should be easy, without incurring expense, to get the gas authorities to put in an increased service, and to fix in position a 40-light meter. It would be possible, further, to carry a 1¼-inch rising main from the meter to some convenient height, and to reduce it on the second or third floors—making connections with the existing pipe and with the various main branches *en route*. No doubt these branches would still be unequal to supply the burners with sufficient volume at low pressure; and hence a meter governor would be useless. The existing meter governor could be used for controlling the pressure to the gas-cooker in the kitchen at 10-10ths, and a smaller mercurial governor could be fitted on the sixth floor level, to control the pressure for the gas-stove. Governor burners could also be used. There were several forms of such burners; but there were none at once so reasonable in price and so scientific in construction as the "Needle" governor burner made by their neighbour, Mr. Bruce Peebles. These burners met the case in point; and if, to complete their imaginary taste of improving the conditions described, they fitted these burners throughout their West-End mansion—carefully assorting the sizes of burners to the light required—the work would be well done, and would be worth doing, in the interests of the consumer.

After describing the development of the gas-burner, Mr. Macfie, speaking of the regenerative form of burner, said that there were those, of whom he was one, who thought highly of that system, and who were content to take all the trouble and risk which the use of these lamps involved, in view of the quality and colour of the light, its diffusiveness and penetration, its steadiness and its lighting duty. But reference had still to be made to the most marvellous development which had yet taken place in the history of gas lighting. The story of the Welsbach incandescent gas-burner read like a romance. It was a triumph of chemical research and mechanical skill; and the perfection of its manufacture had been arrived at by the overcoming of technical difficulties. It was not sufficiently realized that a considerable waste of gas might take place in the use of the incandescent burner, as with any other system of gas lighting; and therein was a field for efficient control. As they had seen, in ordinary circumstances a uniform pressure of 10-10ths was unknown; and the need for governing became apparent. Where the pressure at the burner did not exceed 6-10ths to 8-10ths, an incandescent burner could not give satisfactory results, as the flame would have little life—barely filling the mantle, and making it only partly incandescent, while blackening it at the top. On the other hand, where the pressure exceeded 10-10ths during the day, and increased after dark to 20-10ths or 30-10ths, the bunsen flame would be found to shoot over the mantle, and would probably cause a reddish ring outside the mantle. Then, instead of 2¾ cubic feet, it might consume 3½ cubic feet, with no perceptible increase of light. Such a flame, being non-luminous, did not smoke, and was not visible when shades were used; but it was wasteful, and unduly vitiated the atmosphere. This feature should, therefore, be carefully looked for; and where in evidence, a volumetric governor, set to consume 2¾ cubic feet, should be fitted undern eath each burner.

The one and only drawback to the universal adoption of the Welsbach burner was the frail and perishable nature of the mantle. Every attempt to preserve the mantles from breakage was to be welcomed; and there had been many such. It was with some misgiving that he brought before them a modest effort of his own in this direction. The presumption was that many mantles were broken in putting on or taking off the chimney—due to its tight fitting. A bunsen burner did not, *per se*, require a chimney; and the Welsbach mantle did not require a chimney for its incandescence. A chimney was, however, an advantage in directing the draught, and as a protector; but it need not be gripped at its root, nor descend much below the point of issue of the flame. The device before them was a suspension chimney, with the ends in view of giving ease in placing in position and withdrawing for cleaning, and decrease of draught by a larger diameter and by stopping short just below the mantle. The article was not, and might never be, on the market; but it was there for illustration.*

The lighting quality of the incandescent mantle was more intense than diffusive; and in actual use it was realized that its best light was given on the horizontal plane, while its downward light depended largely on the shade used. Professor Lewes emphasized the merits of the "Holophane" globe for the enhancement of its lighting value by diffusion below the horizontal plane, These Holophane globes showed a combination of horizontal and vertical prismatic lines, which combination diffused the light evenly, and reduced the glaring intensity of the concentrated light-point. The series of tests made by Professor Lewes were almost startling in their results, as ascertained on the radial photometer; and even if, in actual use, they should fall short, the gain must be considerable, and the adoption of that type of globe was assured. At an angle of 45°, the clear Holophane showed a gain of light equal to 12 per cent. Ground-glass globes showed a loss equally great; and white opal, a loss of 2 per cent. It had to be added that no claim was made on behalf of the Holophane globe that it increased the source of light, but only that it utilized the light emitted, and distributed and diffused it in the required direction; and this was a clear and practical gain.

The Welsbach burner had come to stay; and they should be ready not only to keep in touch with progressive improve-

* The arrangement referred to by Mr. Macfie is illustrated and described to-day in our "Register of Patents," p. 132.—Ed. J. G. L.

ments in gas lighting, but to welcome every new development which scientific attainment could accomplish in the direction of giving them "Light, more Light." These considerations led to the following conclusions: That the usual conditions of supply rendered uniform pressure at the consumers' meter impossible, and that the variations in pressure inevitably resulted in unequal duty in the ordinary use of gas for lighting and heating, and tended to wasteful consumption of gas, and undue vitiation of the atmosphere; that, as a rule, the pressure at the meter-outlet was excessive, and ought to be governed or controlled in some efficient way; that if meters were of sufficient capacity, and the indoor piping were properly distributed, and at the same time large enough for the duty required, meter governors should be universally adopted, in the interests of true economy and healthy atmospheric conditions; that for a system of flat-flame burner lighting, meter governors should be adjusted at 4-10ths to 5-10ths pressure, and in such cases non-regulator burners should be used, while for lofty buildings governors should be fitted on each alternate floor; that where gas-stoves or incandescent burners were in use, meter governors should be adjusted at 10-10ths to 12-10ths pressure, and in that case ordinary enamel-tip regulator burners should be packed to do duty at 10-10ths pressure; that where pressure and volume in the same installation varied owing to irregular and insufficient piping indoors, meter governors should be used only on gas-stove supply pipes, led direct from a point close to the meter-outlet, and separately controlled at a pressure of about 10-10ths, and under these conditions only volumetric flat-flame governor burners should be used, and similar governors should be fitted to each incandescent burner—tests being made to see that the pressure at the point of issue for incandescent burners should not be less than 10-10ths; that flat flame burners should be selected to suit the quality of gas in use and the light required, and that the burner-tips should be renewed periodically; that the ordinary single regulator burners were wasteful at all pressures above 10-10ths, and were ineffective where pressure was much lower; that adjustable or adaptable burner-tops only partially met the inequalities referred to, and were in no sense automatic in their action, but might be made serviceable in the interests of improved lighting and economy, by an intelligent and careful adjustment of tops and bottoms to suit the average conditions of pressure in each case; that the lighting duty of coal gas might be doubled or trebled beyond its nominal candle-power value by the use of regenerative gas-lamps or incandescent burners, and that, in addition to the resulting economy, the atmospheric conditions were (under both systems) greatly improved, owing to the more perfect combustion of a smaller volume of gas for the duty performed.

Discussion.

Mr. KERR, architect, in opening the discussion, remarked that, when they received intimation of a lecture about gas, one would have thought they were a good many years behind the times; but Mr. Macfie had shown them that, not only in the latest incandescent light, but in many other ways, gas had made such enormous strides that it was not a thing to be laughed at, but that it was worthy of their consideration. There was no doubt there was a great deal in the future for gas lighting. He had heard about the "Holophane" globe; but it was a difficult one to get. He did not know anybody using it; and he had never come across it in the market. He should say, with reference to Mr. Macfie's hanging chimney, that he thought he observed an improvement in the light with it. He proposed a hearty vote of thanks to Mr. Macfie for his interesting and able lecture.

Mr. J. M'GILCHRIST (Dumbarton) said he had not a word to add to the information Mr. Macfie had given them. If there was just one thing he thought he did not go far enough in, it was with regard to the size of pipes in tenements. He thought Edinburgh should take an example from the thriving "village" on the Clyde, called Dumbarton, and have a standard of sizes to guide all gas-fitters in their work. For the last eighteen years no house in Dumbarton had been fitted up, and gas supplied, except in accordance with the standard regulations to be had at the gas office.

Mr. HUNTER (Edinburgh) said he was not a gas engineer, but he thought the Gas Commissioners were attacked very gently. Only last year he lodged a motion with the Gas Commission, for providing more light, not only in the principal thoroughfares, but in other streets of the city. He had been in many places; and he thought that Edinburgh was the worst-lighted city he knew. He stood in the peculiar position of being a Town Councillor on the one side, and a Gas Commissioner on the other; and he was apt to be told by his brother councillors that, as a Gas Commissioner, he wanted to increase his gas bill at the city's expense. He was against the candle power being reduced, for the reason that many of the larger houses in the city had not the pipes to convey the poorer gas; and the consequence was they had grumbling on every side. Not long ago a gentleman on the south side of the city complained very much that his gas was such that he could not see. When the cause was investigated, it was found that instead of having about 18 or 20 burners, he had added about 150; and he expected that he would get the same light as before. Speaking of burners, he knew one of the most prominent men in Prince's Street, who complained of the bad gas. A Gas Commissioner said to him that the burners must be bad. "Burners," the man said, "I have had those burners for twenty years." Some years ago, he was in Belfast; and he thought that was the best-lighted city he had seen, with gas. He hoped it would not be long before Edinburgh was also one of the best.

Mr. R. MITCHELL said he had had great pleasure in listening to Mr. Macfie's lecture. Mr. Macfie had confirmed his (Mr. Mitchell's) statements, made over and over again, as to the supply of gas and burners in dwelling-houses. He thought it was a great mistake for the gas supply that architects did not specify tubes of sufficient size for new houses. It did not matter to the plumbers. They were blamed for it in the first instance, and the gas manager was blamed in the second. There should be, as in Mr. M'Gilchrist's case, a set of regulations for gas-pipes. The sooner that the Gas Commissioners took up this subject the better. It was not at all fair that officials should be complained of for supplying a bad quality of gas, when it was the architects who failed in their duty.

Mr. J. PATERSON (Edinburgh) said the lecture had strengthened his opinion that they had not seen the end of gas yet; and he had discovered that he was not yet too old to learn. He had pleasure in seconding Mr. Kerr's proposition.

Mr. MACFIE, in returning thanks, said that in Edinburgh the gas was about 10 candles better than it was in Belfast; but in the latter place, they burned a great deal of it. They could get plenty of light from gas as well as from electricity, if they burned it rightly; but they could waste it as well, and not get the light from it. Speaking about the great increase in the consumption of gas, he said that if they lowered the illuminating power of their gas they would soon increase the consumption. There was more gas wasted than was ever used. If he were a Gas Commissioner, he would wish to reduce the consumption, if by doing that he could teach the public how to burn gas. As to the sizes of pipes, he had procured the standard sizes approved by the North British Association of Gas Managers at their meeting in Perth in 1890; and he would recommend them to the consideration of plumbers, though he believed they would surprise them.

The vote of thanks was unanimously accorded.

New Offices for the Newcastle and Gateshead Water Company.—Last Tuesday, the Newcastle and Gateshead Water Company formally opened new offices, which have been erected by them in very handsome style, and which, it is acknowledged on all hands, are well worthy of the great city. Representatives of the local authorities attended the inaugural ceremony; and the speeches made afforded testimony of the good relations existing between the City Council and the Company.

The Costs of the South Molton Gas Order.—The costs incurred by the South Molton Corporation in the promotion of the Provisional Order of last session for the purchase of the local gas-works, amounted to £237 16s. 6d. At a meeting of the Town Council last Tuesday, it was decided to apply to the Local Government Board for power to borrow this amount, or the sum of £200, as may be considered advisable. Alderman Shapland proposed that the money should be paid out of revenue, instead of being added to the liabilities of the town; but only he and the seconder of his motion favoured this course.

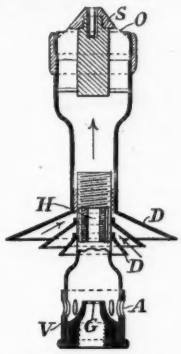
The Caerphilly Water and Gas Bill.—Last Tuesday the Caerphilly District Council discussed the question of proceeding with their Bill in Parliament, by which they intend to seek power to construct additional water-works, to obtain a further supply of water for the district, and to acquire the undertakings of the Caerphilly Gas and Water Company, Limited, and the Taff's Well Gas and Water Company, Limited. A letter was read from Messrs. Durnford and Co., the Parliamentary Agents, stating that they did not consider the Council could safely make any terms with the promoters of the Rhymney and Aber Valley Water Bill which would involve the withdrawal of their own Bill. They pointed out that the Rhymney Bill was open to serious objections, and seemed likely to meet with much opposition in Committee from other quarters. The Chairman observed that it was possible the Rhymney Company's Bill would be thrown out in Committee. It appeared to him, therefore, that the Council must promote their Bill; otherwise they might find themselves without water. It was unanimously decided to proceed with the Bill.

The Dublin Corporation Bill.—The Dublin Municipal Council held a special meeting yesterday week to confirm the propriety of promoting a Bill in the next session of Parliament, which will deal, among other matters, with the supply of water to the out-townships. Addressing himself to this question, the Lord Mayor said there appeared to be no question about it that the Corporation had been disgracefully treated by the townships. They were fortified by the decision of Parliamentary Committees; and their finding was altogether in favour of the water clauses of the Corporation Bill. He might take the opportunity of mentioning that he had tried within the past week or fortnight to bring about a settlement as between the premier township and the Corporation. But he was sorry to say that his efforts had failed; and the promises made to him had not developed into what he had hoped to see brought about. He trusted, for the sake of the townships and of the city, that a better spirit would yet prevail, and that they would be saved the expenditure of £5000. The only suggestion that had been made was arbitration. Both Houses of Parliament, however, had decided that the townships were to pay so much for water over and above 20 gallons per head per day. What, then, were they to arbitrate about? The Right Hon. J. M. Meade said that what they wanted was merely to have contracts, solemnly entered into twenty and more years ago between the Corporation and the townships, put into legal shape, so that the Corporation should be fairly paid on the terms of those contracts for the water supplied. He moved a resolution confirming the propriety of promoting the Bill; and it was adopted without a division.

REGISTER OF PATENTS.

Atmospheric Gas-Burners.—Moeller, J., of Palmer Street, Westminster. No. 24,839; Dec. 27, 1895.

This invention relates to gas-burners in which a mixture of gas and air ascends a tube, at the mouth of which it receives additional air, and burns with a highly heating flame—the object in view being "to effect a very complete and uniform mixture of the gas with air, in larger proportion than usual before reaching the burner-mouth, and thus to secure a more complete combustion, while, at the same time, the flame is prevented from striking back."



As shown in the engraving, the patentee proposes to supply the gas at the bottom of the burner-tube by numerous very small holes G, preferably arranged in a circle. At successive heights above these gas-inlets, there are provided through the sides of the burner-tube holes H, for ingress of air, so arranged that the jets of entering air are directed obliquely upwards and inwards—at angles determined by conical deflectors D, screwed on the tube. Above the highest of the air-inlets, the tube is closed by a cover, through which there is an annular outlet O, of fine wire gauze, or a number of small holes circularly arranged, for the passage of the gas and air mixture to form the flame. When the burner is employed for incandescent gas lighting, the cover of the tube is made with a socket S, to receive the stem of a support for the mantle. Besides the holes H, there are the usual holes A for the admission of air at the lower part of the tube; their opening being regulated by a valve-ring V, having through it corresponding holes which, by turning the ring, can be moved more or less out of coincidence with the holes through the tube.

Gas-Engines.—New, A. G., of Palace Chambers, Westminster, S.W. No. 624; Jan. 9, 1896.

In the majority of gas and oil engines at the present time, the piston only receives one impulse every second revolution, owing to the fact that the first action draws in the mixed gases, the second compresses them, the third gives the working explosion, and the fourth is the exhaust. Consequently, considerable loss of power is incurred during the take-in and exhaust movements. The present invention enables the piston to obtain an impulse every revolution.

The method employed for doing this is by providing more than one cylinder for each piston, and so constructing the engine that the piston, after being driven forward by the explosion, comes out of the working portion of one cylinder and returns into another, where it compresses mixed gases which the arrangement of parts has provided for it there, and which then explode, and give it another impulse from that cylinder. The working pistons may be made to go from one cylinder to another—the cylinders being arranged in a circle; or the pistons may be made so that each one works alternately in two cylinders provided for it.

The most advantageous method is to arrange two cylinders on radial lines to the shaft, and mount these cylinders on loose bearings on the shaft. The piston is arranged to travel backwards and forwards on the same radial lines relatively to the shaft on to which it works by means of an ordinary crank. The piston, at the end of its forward stroke, comes out of the cylinder entirely, and is then carried in a fixed casting, which forms a continuation of the working cylinder; and whenever the piston has arrived in this position, the cylinders are rocked through an angle above the shaft, bringing the second one into the exact position originally occupied by the first one. The piston on its return, therefore, enters this second cylinder. It is proposed to completely enclose the space between the cylinders and the shaft with an air-tight case, and to fit on the shaft inside this case one or more fan propellers, or other means for exhausting the chamber of any air or gases which may happen to be in it at the time. The object of this exhaust is to draw out the exhaust gases at the end of each stroke, and after having done so, and drawn in air, to assist the air in being forced through a suitable pipe connected with the chamber into the cylinder which is about to work. This air, on its way to the cylinder, takes up the necessary gas or oil vapour, and forms the combustible mixture ready for the piston to compress.

The Intimate Mixture of Gas and Air for Incandescent Burners.—Denayrouze, L., of Neuilly, France. No. 1578; Jan. 22, 1896.

The claim for this invention is: "For incandescent gas lighting, the method of effecting an intimate mixture of air and gas under the combined conditions, as to the composition, the pressure, and the velocity of the mixture, hereinbefore stated." A lengthy specification is provided, the main portions of which are reproduced—referring, as it does, to the inventor's previous patents, already described in these pages. The patents in question are No. 22,615 of 1894 and Nos. 4494, 7722, and 14,053 of 1895.

The patentee says that, in these earlier specifications, he has described means which he was the first to employ in order to obtain "new industrial results in respect of incandescence gas lighting." By his preparation of a mixture of gas and air for incandescence mantles, burned on bunsen or analogous burners, he claims to have realized a lighting power at least five times that obtained in the way in which these burners have been so far used. This mixture of air and gas is, he says, effected as follows:—

"A very small power is applied, causing the molecules of air and gas to interpenetrate each other intimately, by means of a mixer the most simple type of which is a fan. The gaseous mixture thus formed at or near the burner, reaching the mantle under conditions most favourable for combustion, produces the maximum effect. On closely studying the phenomenon, after having practically realized it, I have been led to determine very exactly the manifold conditions which have to be satisfied by mixtures capable of producing such results. Once these conditions were known, I have been able to modify and extend, as I shall describe, the means which I at first employed for producing by such a mixture a light which is new, not only in respect of its splendour, but also in respect of certain special qualities which practice alone has revealed."

The mixture of air and gas should fulfil the following necessary and sufficient conditions: (1) It should have a certain chemical composition; (2) also a certain physical constitution; (3) and it should reach the mantle with a certain velocity. When these three conditions are all properly fulfilled, the complete luminous effect is produced. But if any one of the conditions is wanting, the effect is lessened—the combination determines the production of the phenomenon.

The patentee observed that the blades of the fan-mixer not only triturate and beat the air and gas, but that apparatus of this kind causes the mixture to issue at considerable speed, determined by the tangential velocity of the blades. With a particular mantle, the luminous effect goes on increasing up to a certain velocity, beyond which it decreases, while the pressure of the gas supply does not vary. Hence it is evident that, to consider the burner itself without taking into account at the same time the texture of the mantle and the character and pressure of the combustible supplied, and without also considering the velocity of the mixture as it reaches the particles to be rendered incandescent, is to look on only one part of the question, which "ought to be considered in its entirety, with all its amplitude and the variety of practical solutions of the problem."

When one considers the complete system in regard to the elements producing the light, it is seen that the quantity and quality of the light produced intimately depend on the manner in which the system permits approach to the following result: To give each solid particle of the mantle the maximum energy of vibration that can be realized without destruction or excessive fatigue of any part of the system. Thus stated, in all its generality, the problem admits of various solutions, which may be grouped in three series.

The first series consists of solutions in which the combustible (gas) is taken at the service pressure (20 to 30 mm), and the air at atmospheric pressure; the mantle having the usual weight and volume of those employed with bunsen burners. In this case it is only necessary to adjust within these limits the three conditions for establishing a good luminous system: Chemical composition of the mixture—1 of gas, 3 to 5 of air; physical constitution—pulverization of two fluids; and velocity of the mixture—1·5 to 2·5 metres per second. In this way, there is obtained a mean light with 10 litres per Carcel. Hitherto efforts have been made to produce in the mixture a kind of stable molecular equilibrium; whereas experience shows that the effect desired can be produced only in a fluid in motion. No "new organs" are required, except that, in the system of pipes leading from the single mixer, openings are made proportioned to the volumes of the mantles; and the velocity of issue is rendered approximately the same at all the openings (which may be unequal or unequally distant from the flame) by partially throttling them with wire gauze, so as not only to regulate the velocity, but the time requisite to ensure against explosion by the flame striking-back.

The second series consists of solutions in which, while the mantle is that usually employed with bunsen burners, the air and gas receive an initial pressure higher than that in the service-pipes and the atmosphere. Good mixture can also be obtained in this way. It is only necessary and sufficient that the two fluids should lose, by means of baffles, the excess of velocity due to the initial pressure. Thus, if the blades of the fan-mixers were stationary, so as to become simply baffles, and if the air and gas arriving separately under pressure had first to divide themselves in passing between these blades, and then the fan forced their laminæ against each other for intimate mixture through perforated plates or wire gauze, the result would be so much the better the more by these means approach were made to the three conditions of: Composition, 1 of gas to 3 or 4 of air; intimate trituration; velocity of issue, 6 to 12 metres.

The third series consists of solutions in which the incandescent bodies are no longer mantles of woven filaments, but are porous masses relatively thick. In this case, the quantity of combustible gas and the velocity of the intimate mixture have both to be greater, the greater the mass of the body to be incandesced relatively to its volume. For apparatus of this kind, the gas alone (or both the gas and air) may be used under pressure. The speed of issue of the mixture should be greater, the thicker the particles which it strikes as it issues. There is in this way no other limit to the production of the luminous effect than the resistance of the particles of the incandescent body to the mechanical force which tends to disperse them, or the heat which tends to fuse them. In this apparatus, violent incandescence effects can be produced by using "amadou" or sponges impregnated with usual liquids formed for salts of earths employed for making Welsbach mantles. Another good process consists in using naturally porous bodies sufficiently refractory—such as pumice stone or retort carbon, or bodies artificially made, having approximately the same molecular constitution. The form and texture of these porous bodies may be varied at will. Instead of very compact bodies, a sort of simple cartridge may be formed, containing filaments close together or entwined. Any kind of bundle, faggot, skein, or tow of refractory wadding, forming a whole sufficiently strong, may (says the patentee) give good results, so long as the conditions of chemical composition, physical constitution, and velocity of the issuing mixture are fulfilled.

Gas-Engines.—Bamford, F., of Salford, and Wadsworth, W., of Chorlton-on-Medlock, Manchester. No. 2753; Feb. 6, 1896.

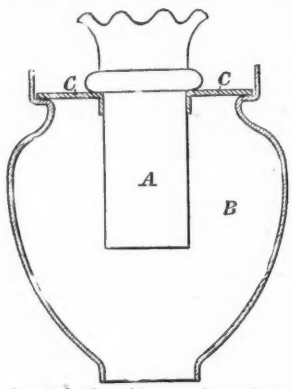
These improvements consist of (1) an arrangement of cams (or other equivalent means) for automatically controlling the extent of opening of the valves for the admission of gas and air according to the speed at which the engine is running; (2) arrangement in the cylinder for increasing or diminishing the area of the space in which the mixture is compressed before ignition; and (3) a method of clearing out the products of combustion left at the end of the exhaust-stroke. The advantages to be gained by these improvements are said to be that the initial pressure both of ignition and compression remains practically constant, to whatever extent the valves for the admission of gas and air may be opened; the mixture always contains the same percentage of gas and air, to whatever extent the admission-valves are opened; the volume of mixture admitted is in proportion to the load—thus ensuring steady and economical governing; and at the end of the exhaust-stroke, the remaining products of combustion are cleared out. This ensures a clean pure charge to be fired at each cycle.

Incandescent Gas Mantles.—Mackean, W., and the Incandescent Gas-Light Company. No. 3681; Feb. 18, 1896.

In their specification, the patentees remark that hitherto in the manufacture of incandescent gas-burner hoods or mantles, "according to one method the oxides of suitable metals have been mixed with some agglutinating material, and formed into threads by forcing the paste through a die or draw-plate (shaping the threads as may be required), and then calcining. According to another method, a suitable fabric is impregnated with a solution of the salts of the metals, dried, and burnt, leaving a skeleton of the oxides." According to the present invention, the oxide, or a mixture of two or more oxides, either hydrated, or anhydrous, or the carbonates of the oxides, or mixtures of both, are mixed with an ammoniacal salt, such as the nitrate, acetate, or sulphate; sufficient water being added to give any desired consistence. Suitable fibres or fabrics are then impregnated with the mixture and dried; and the fibre or fabric is then burned, as in the manufacture of "Welsbach" mantles. As when the hydrated oxides of the rare earths are heated with an ammoniacal salt such as the nitrate, the ammonia is expelled, and a nitrate of the earth or earths is formed, so in like manner the oxides of carbonates of ytterite earth, as well as the oxides of carbonates of cerite earth—such as lanthanum, didymium, and cerium—may be decomposed, and converted into soluble salts. The reaction takes place when burning out the fabric after impregnating the mantle, leaving a coherent skeleton of the oxide or oxides employed.

Globes and Chimneys for Incandescent Gas-Lights.—Macfie, D., of Edinburgh. No. 3759; Feb. 19, 1896.

This invention has for its object "to obviate or lessen the risk of breakage of the chimneys and mantles used in incandescent gas lighting." When the chimney A is made separately from the globe (as shown), it is formed with a flange or collar, or with projecting studs or arms around it, by means of which it is suspended in the orifice at the top of the globe B, or in a plate or disc C carried by the globe, so as to hang over the mantle. The flange may be made by expanding the glass at top in annular bulbous form.



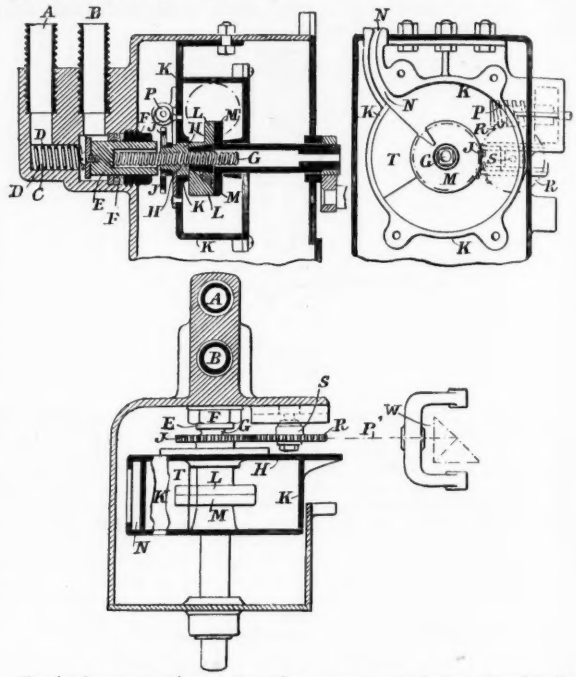
When no globe is used, the chimney formed as described may be suspended over the mantle by a wire frame or other holder engaging the flange or collar.

When the chimney is formed in combination with a globe, the globe may be of spherical or other form, adapted to fit the gallery support on the burner; but instead of terminating at the top in the opening through which the ordinary chimney is passed, it is there united with a funnel extending downwards centrally within the globe, so as to surround the whole or part of the length of the mantle, or merely to depend over it, and create the necessary draught.

Coin-Freed Meters.—Greenall, J., of Leeds, and Heaton, T. T., of Nunhead, S.E. No. 25,008; Nov. 7, 1896.

The illustrations show sectional elevation, side view, and plan of the proposed prepayment meter mechanism.

A is the gas-inlet connected to the main; and B, the gas-outlet connected with the inlet of the meter for measuring the gas. The inlet and outlet are connected together by the passage C. E is a sliding-valve, which works in a stuffing-box and gland F, which prevents gas escaping into the interior of the coin-freed mechanism; while a spiral spring D tends to keep the valve E open. G is a screw, having four of its sides flattened by milling; and H is a nut in which G turns. J is a spur-wheel attached to the nut, which is carried in bearings in a casing K—a split plate keeping the nut in a stationary position. L is a weighted disc, the central portion of which has a square interior. It may be adjusted in position relatively to the centre, and there fixed by a set-screw. M is a disc, carried on a hollow spindle, on which is keyed a handle. When the discs L M are at rest, the slots in them are exactly side by side. N is a shoot for the passage of a coin to the slots, and having an opening at the back of the passage, which allows the coin to fall through, should it be under the required size. P is a worm, actuated from the indicating mechanism W of the meter by the bevel wheels and spindle shown. R is a spur-wheel which transmits motion from the worm P to the wheel J. This wheel is fitted on an adjustable centre S, mounted in a slide. T is an incline; and V is an opening in the cover of the casing K.



To obtain a prepaid quantity of gas, on a coin being placed in the shoot N, it will travel downwards, and enter the slots and lock the discs L and M together. The discs are then rotated; and one portion of the disc L having a square interior, the screw G is rotated, and is thus turned and moved back in the nut H. During this time, the coin holds the discs firmly together until it reaches the incline T, where it becomes forced from its position, and ejected into the casing through the opening V. Thus, one coin can only serve the purpose of locking the discs L and M together for one revolution; so the screw G is only withdrawn a single pitch for a single coin. But several coins may be inserted in the apparatus one after the other—a rotation of the handle being effected for each coin; and the screw may thus be withdrawn the distance of a number of threads by successive turns of the screw. The shoulder inside the hollow spindle regulates the maximum quantity of coins which may be inserted before gas is consumed. The withdrawal of the screw allows the spring D to press the valve E away from its seat, so as to open the passage C, and permit of gas passing from A to B, and thence to the meter.

During the consumption of gas, the worm P is rotated by the spindle connecting it to the indicating mechanism of the meter. The rotation of the worm turns the wheel R, which in its turn transmits motion to the spur-wheel J; and the latter, being firmly connected to the nut H, turns the latter, and so advances the screw G. In this way, as gas is consumed, the screw is gradually advanced, until it presses the valve E against its seat and cuts off the gas.

The adjustment of the centre of the wheel R enables it to be set in the right position to engage a change-wheel properly with the wheel J, so that the quantity of gas supplied for any specified coin may be varied at will.

APPLICATIONS FOR LETTERS PATENT.

160.—Holme, W. J., "The limelight incandescent mantle." Jan. 4.
187.—Oppenheimer, G., "Incandescent gas mantles." Jan. 4.
190.—Brookes, J., "Incandescent gas-burners." Jan. 4.
238.—Marshall, H., "Bunsen gas-burners." Jan. 5.
294.—Kern, O., "Incandescent gas-burners." Jan. 5.
298.—Hervieu, G., and Macké, L., "Generating acetylene and other similar gases." Jan. 5.
327.—Böhlmark, A., "Burners for cooking-stoves." Jan. 5.
328.—Zimmerman, J., "Forming and burning acetylene and similar gases." Jan. 5.
330.—Sugg, D. W., "Incandescent gas-burners." Jan. 5.
491.—Symons, P., "Atmospheric gas-burners." Jan. 7.
501.—Langhans, R., "Manufacture of incandescing media for use in incandescent gas lighting." Jan. 7.
512.—Lebrun, G., and Cornaille, F., "Producing acetylene gas." Jan. 7.
520.—Glover, R. T. & J. G., "Coin-freed gas or other fluid meters." Jan. 7.
555.—Wellington, F. F., "Gas and other engines." Jan. 8.
562.—Boutet, J. F., and d'Angicourt, E. A., "Generating by the expansion of gases motive power applicable to all kinds of fixed or movable machines." Jan. 8.
572.—Cowper-Coles, S. O., "Internal combustion engines." Jan. 8.
589.—Zimer, F. W., "Attachments to gas-burners for heating and lighting purposes." Jan. 8.
658.—Tèdé, L., "Production of acetylene." Jan. 9.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Tyne Boghead Cannel.

The proprietors of this cannel (Messrs. T. W. Dance and Sons) write to the effect that they are desirous of correcting a misstatement which they learn has recently been circulated, to the effect that their seams of cannel are now nearly exhausted. Instead of this being the case, they say that, at the present rate of output, there is sufficient of the material unworked to last for thirty or forty years. We may add that the misstatement referred to did not appear in our columns; and it is only the peculiar circumstances which Messrs. Dance and Sons are able to mention that have induced us to thus lend them assistance in dispelling the erroneous impression it is calculated to produce.

Is Incandescent Gas Lighting Receiving Fair Play?

A correspondent sends us the following remarks: It is becoming a question whether incandescent gas lighting for public thoroughfares is receiving fair play in many of the places where it is in the experimental stage; and as this is so, it would perhaps pay in the end if the Companies who are exploiting this system of lighting retained the services of a practical man for the purpose of demonstrating and explaining the advantages of the light to public bodies, and also for spending a few days in supervising and superintending an installation. It has been found that some surveyors make a decided set against the system, and formulate the most elaborate reports thereon; the object being to discredit the light on the ground of efficiency as well as economy. In certain cases, a strong-minded and strong-willed local legislator, who prefers to believe his own eyes and trust to his own personal observations, is not content with the mere report of the Surveyor, but insists on bringing forward points left out of the report or else so curtailed as to be almost valueless; and this almost invariably results in the appointing of a Committee. Then some explanations are afforded; and at the next reporting stage the Surveyor is found to be more favourable to the light, and more convinced of its comparative cheapness than the members of the Committee, and eventually the system is adopted. It is not, however, the fortune of every local governing body to possess a member who has a will of his own; and in such cases the verdict of the Surveyor is final, and incandescent gas lighting is left out of the *agenda*. Admitting that in some rural districts the adverse report is mainly, if not entirely, due to inexpertness on the part of the Surveyor (who sometimes is by right entitled to no higher appellation than that of foreman of the road-menders), there are without doubt a number of places where the system has not had a fair trial because the Surveyor is antagonistic to its adoption, or possibly because he is interested in another method of lighting. Surveyors are unquestionably, as a body, honourable men; but when tests and experiments of this sort touch their individual interests, they often fail to use that perceptive ability which at other times characterizes them. For this reason, if for no other, it would be as well if those who are concerned for the success of incandescent gas lighting, took steps to ensure a proper trial of their system in all places where it is put on as an experiment.

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1897).

Opposition on Standing Ord

On Saturday, the 9th inst., the limit of time allowed for depositing at the Private Bill Office memorials complaining of non-compliance with Standing Orders in the case of the first hundred on the General List of Petitions for Private Bills for the ensuing session, memorials had been presented in respect of the petitions for the Fylde Water-Works Transfer Bill, the Gravesend and Northfleet Water Board Bill, the Hunstanton Water and Gas Bill, the Malvern Link Urban District Gas Bill, and the Rhymney and Aber Valley Gas and Water Bill. These measures will therefore be opposed at the initial stage.

The petitions for the following Bills, which are comprised in the first hundred, will go forward: Arundel Gas Bill, Ashford Gas Bill, Ashford (Urban District Council) Gas Bill, Belfast Water Bill, Bolton Tramways and Improvement Bill, Caerphilly Urban District Council Bill, Colne Corporation Bill, Crays Gas Bill, Eastbourne Corporation Water Bill, Eastbourne Water Bill, East London Water Bill, East London Water-Works (Purchase) Bill, Grand Junction Water-Works Purchase Bill, Gravesend and Milton Water-Works Bill, Huddersfield Corporation Bill, Kingston-upon-Hull Corporation Bill, Lambeth Water-Works (Purchase) Bill, Leicester Corporation Bill, Loughborough Corporation Bill, Lowestoft Water, Gas, and Market Company Bill, Manchester Corporation Bill, Newark Corporation Water Bill, New River Company Bill, New River Water-Works (Purchase) Bill, Nottingham Corporation Water Bill, Perth Harbour, City Improvements, and Gas Bill, St. Anne's-on-the-Sea Gas Bill, Southampton Corporation Water Bill, Southwark and Vauxhall Water-Works (Purchase) Bill, Swadlincote Gas Bill, and the West Middlesex Water-Works (Purchase) Bill.

The Complications at Cromer.—The difficulty which arose in connection with the proposal of the Cromer District Council to purchase the local gas and water works, owing to several members being shareholders in the Companies, has been overcome by the County Council, on the initiative of Lord Kimberley, granting a dispensation to such shareholders, by which they are enabled to vote on questions in which the Companies are interested.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, Jan. 14.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* LOPES *and* CHITTY.)

Bayley v. The Incandescent Fire-Mantel and Stove Company, Limited, and Others.

This was an appeal by the defendants from the verdict and judgment in the trial of the action before Mr. Justice Cave and a special jury on the 3rd ult. (see "JOURNAL" for Dec. 8, p. 1134).

Sir E. CLARKE, Q.C., M.P., Mr. R. M. BRAY, and Mr. H. NIELD appeared for the appellants; Mr. BIGHAM, Q.C., and Mr. T. G. CARVER represented the respondent.

The action, it may be remembered, was brought for the rescission of a contract for shares in the Company; and there were also claims against the Directors for fraudulent misrepresentation, by means of which the plaintiff was induced to take the shares. Fraudulent misrepresentation was found against the Directors; and judgment was given, as against the Company, in favour of the plaintiff for the cancelling of the contract and the return of the money paid—£75. On behalf of the defendants, it was contended, first, that there was no evidence to go to the jury that the representations in the prospectus were untrue in fact; secondly, if untrue, there was no evidence of fraud; and, thirdly, that there had been misdirection in allowing the plaintiff to give evidence of what he understood by the terms of the prospectus, while the defendants were not allowed to call shareholders to show what they had understood. It was also urged that the jury had not assessed damages as against the Directors; and had it not been for the finding of fraud, it was possible the appeal would not have been presented. During the course of the opening,

The MASTER of the ROLLS asked whether, if the charges of fraud were withdrawn, the defendants were content to let the verdict against the Company stand.

Sir E. CLARKE said he should advise his clients to adopt this course.

The MASTER of the ROLLS suggested that the Counsel engaged should try to come to some arrangement. He said he observed from the notes that the learned Judge who tried the case did not agree with the verdict.

After a short consultation, all charges of personal fraud against the Directors were withdrawn; and, by consent, the verdict and judgment against them were directed to be set aside, and judgment entered for them—the judgment against the Company to stand. The plaintiff was to be paid the £75 and his taxed costs of the trial in the Court below; but no costs were to be allowed to either party on the appeal.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Jan. 12.

(*Before Mr. Justice* ROMER.)

Incandescent Gas-Light Company, Limited, v. Armfield.

Mr. TERRELL, Q.C., moved for an injunction to restrain the defendant from infringing the plaintiffs' patents of 1885 and 1886. He said the mantles sold by the defendant had been analyzed, and found to be infringements. Several injunctions had been granted on precisely the same analysis as in the present case.

Defendant, who appeared in person, said he bought the mantles after making all necessary inquiries, and was assured that they were not infringements. He did not wish to contest the validity of the patents, or go to any expense in the matter.

Mr. TERRELL said that, as enormous quantities of these mantles were being imported from Germany, it was absolutely imperative that the plaintiff Company should stop the sales.

Justice ROMER said it was not his duty to advise the defendant, but he might point out to him that he would be in great difficulty hereafter. Would the defendant undertake, until the trial, not to sell any mantles not made in accordance with the plaintiffs' patents?

Defendant said he supposed this was the only course open to him.

Justice ROMER said it was; and he would advise defendant either to come to terms with the plaintiffs or consult a solicitor.

Defendant remarked that he was not in a position to employ professional assistance.

Mr. TERRELL said he was instructed that the defendant was in a large way of business. If he would consent to the motion being treated as the trial of the action, and deliver up all mantles in his possession, the plaintiffs would not proceed with the inquiry as to damages.

Defendant said he purchased the mantles from a Mr. Marsden, against whom an action had been brought, though with what result he did not know.

Mr. TERRELL said Mr. Marsden gave an undertaking not to further infringe.

After some discussion, defendant undertook not to make, sell, or use the mantles complained of.

His LORDSHIP at the same time warned him that if he broke the undertaking, he would be liable to be sent to prison.

Incandescent Gas-Light Company v. Coathupe.

In this case, the plaintiffs claimed an injunction restraining the infringement of their patents of 1885 and 1886. The evidence was the same as in the previous case; and the defendant consenting to treat the motion as a trial, an order was made restraining infringement.

In two similar cases, in which the defendants were Burine and Smythe, injunctions were granted.

Saturday, Jan. 16.

(*Before Mr. Justice* KEKEWICH.)

The Incandescent Gas-Light Company, Limited, v. Yeomans.

This case came before the Court upon a motion for judgment in default of appearance on defendant's part. The facts were the same as in many previous cases; and a similar order was made.

(*Before Mr. Justice* STIRLING.)

The Incandescent Gas-Light Company, Limited, v. Hinton—Same v. Stein.

In both these actions, in which the defendants were not represented, injunctions were granted, with costs as between solicitor and client, restraining infringement of plaintiffs' 1885 and 1886 patents.

(*Before Mr. Justice* ROMER.)

The Incandescent Gas-Light Company, Limited, v. Oxley—Same v. Empire Manufacturing Company.

These were actions of the usual character for infringement of the plaintiffs' patents of 1885 and 1886; and they came on as short causes—no defence having been put in. The usual order was made in each instance for an injunction, an inquiry as to damages, the delivery up of infringing mantles, and full costs to be taxed, up to and including the judgment, with liberty to apply in Chambers as to the payment of damages and subsequent costs.

Action Arising out of the Explosion in the Strand.

In the Queen's Bench Division of the High Court of Justice last Friday, the case of *Love v. The Gaslight and Coke Company* came before Baron Pollock and a special jury. It was an action for damages arising out of the gas explosion in Church Court, Strand, in October, 1895. The plaintiff was a dealer in ferns and plants in Covent Garden Market, and resided in the court; and the only question at issue was the amount to which he was entitled as compensation for injury to his furniture and some ferns and plants in his yard. Ultimately the jury returned a verdict for £20; and for this judgment was given, with costs on the County Court scale.

The Thames Conservators and the Abstraction of Water from the Thames.

In the Queen's Bench Division of the High Court of Justice last week, before Mr. Justice Mathew, an action was brought by the Conservators of the River Thames for an injunction to restrain the Southwark and Vauxhall Water Company from taking from the river a greater quantity of water than was provided for under agreements entered into between the parties in 1852 and 1886. The defendants pleaded that the agreements were *ultra vires*. His Lordship took time to consider his judgment, which he delivered yesterday, at some length, in favour of the plaintiffs; but he stayed execution for the present. Our report of the case is unavoidably held over till next week.

Rectifying a Gas Bill.

At the Westminster County Court last Tuesday, his Honour Judge Lumley-Smith, Q.C., had before him an application by the defendant for a new trial of the case of *The Gaslight and Coke Company v. Hayes*. The matter had been referred to the Registrar, who deducted £1 from the claim of £5; but Mrs. Hayes was not satisfied. For the Christmas quarter of 1895, 1300 cubic feet of gas were consumed; but in March the bill sent in was for 27,000 cubic feet. This, Mrs. Hayes contended, was a great deal too much. His Honour remarked that it was absurd to say the consumption jumped up like that. The representative of the Company said the calculation for the Christmas quarter was due to a mistake on the part of the meter inspector; it should have been 11,300 cubic feet; and, of course, this showed in the next quarter. The meter was tested, and found to be 2½ per cent. too fast; and this was allowed. His Honour, after putting further questions, said he thought that the Registrar had not taken off enough. He should therefore deduct another pound, and make the judgment for £3, with costs on that amount.

Wilfully Causing an Escape of Gas.

On Monday last week, George Collins was charged before the County Justices at Ramsgate with having, between the 9th and 10th inst., wilfully removed a plug from a pipe at the Great Minster Gas-Works; thereby causing a loss of gas. Accused pleaded "Not guilty." It appeared that he had been in the Company's service, but had recently left on his own account. Mr. A. Cox, the Manager of the works, stated that about half-past three on the morning of the 10th inst., he was aroused by an employee, who told him there was something wrong with the gasholder. On making an examination, he found that a plug had been removed from a ¾-inch pipe between the scrubber and the purifier, and that considerable waste of gas was going on. Witness afterwards examined the surroundings, and noticed certain footprints about the yard. He then informed the police of the occurrence. The loss of gas amounted to between 8000 and 9000 cubic feet; and this would have been sold at 4s. per 1000. Police-constable Crowe deposed to tracing the footprints to Collins's house; and they were found to correspond with the boots worn by him. There were also marks of gas lime upon his trousers. Witnesses were called who stated that the accused returned home at half-past ten on the night of the 9th inst., and was seen in bed at midnight and again at half-past two in the morning. After a long deliberation, the Bench came to the conclusion that there must be a conviction; remarking that the act with which accused had been charged might have been attended with very serious consequences. He would have to pay £2 8s., inclusive of the damage, or go to prison for 14 days, with hard labour.

The Gas Supply to Luddenden from Sowerby Bridge.—The Sowerby Bridge District Council have resolved to extend their gas-mains to Luddenden and Midgley. The proposals made by their Gas Manager in connection with this work will involve an expenditure of £1500.

New Retort-Settings for the West Bromwich Gas-Works.—The West Bromwich Town Council have, on the recommendation of the Gas Committee, decided to replace two worn-out retort-settings by others constructed on the generator principle, at a cost of £382, in order to make the retort-house plant equal to meeting satisfactorily the anticipated demand for gas next winter.

MISCELLANEOUS NEWS.

THE GAS QUESTION AT SOUTHPORT.

The Southport Gas Committee's Reply to Mr. Bellamy's Report.

In the "JOURNAL" for the 5th inst., we gave a full abstract of the report presented to the Birkdale District Council by Mr. C. R. Bellamy, of Liverpool, on the questions in dispute between them and the Southport Corporation in regard to the gas supply of their district. The report was referred to a Sub-Committee of the Corporation Gas Committee, who had the assistance of the Town Clerk (Mr. J. D. Williams) and the Gas Engineer (Mr. J. Booth); and they prepared a categorical reply, which was duly presented to the Committee. We indicated last week the principal points discussed; but as the full text of the reply has now been published, we are in a position to deal more fully with it.

Taking first Mr. Bellamy's statement that "in 1870 Birkdale obtained powers to erect gas-works of their own, having already laid the district gas-mains," the Sub-Committee say the true history of the matter is as follows: In 1870, the Corporation, finding their gas-works were likely to become inadequate to the growing wants of the borough of Southport and the township of Birkdale, commenced the erection, with the full knowledge and acquiescence of the Birkdale Local Board, of larger works for the supply of both, and were accordingly applying to Parliament in the then approaching session for powers to carry out these works, and were prepared, and had offered by their Bill, to include the township within their limits of supply. A short time, however, before the publication of the notice of the Corporation of their intention to apply for the Bill, a private Company was formed in Birkdale. A majority of its members were members of the Local Board; and its Solicitor and other officers were also the Solicitor to and officers of the Board. The Company then proceeded to apply to the Board of Trade for a Provisional Order to enable them to supply gas in their then township. Against this application the Corporation lodged a strong memorial. Negotiations were then entered upon between the Corporation and the Local Board, with the result that the Company's application was withdrawn, and the Company dissolved. Thus, no statutory powers had been obtained. The mains had been laid years before; as in 1864 an agreement had been entered into between the Southport Improvement Commissioners and the Birkdale Local Board for a supply of gas to Birkdale.

With respect to Mr. Bellamy's statement that "the illuminating power of the gas was fixed at 20 candles when measured with a 15-hole argand burner," the Sub-Committee point out that the words of the section of the Southport Improvement Act, 1871, are "an argand burner, having 15 holes and a 7-inch chimney, or other approved burner and chimney or burners." It is over these words that the chief disagreement has arisen between the District Council and the Corporation. Mr. Bellamy has admitted that a 15-hole argand is not a suitable burner for testing cannel gas; and it is generally regarded as altogether obsolete. The Birkdale Council have, notwithstanding, persisted in using it for testing purposes. In the Sub-Committee's opinion, a settlement of the burner question would clear the way, and would be likely to facilitate the settlement of other outstanding differences.

The next matters dealt with are the price of gas and the profits. Mr. Bellamy in his report stated that "it was specifically stated by Counsel on the Committee proceedings that the same price was to be charged to the consumers in Southport and Birkdale. The Sub-Committee reply that the Bill for the Improvement Act of 1871 was not only unopposed, but expressly agreed to by the Birkdale Local Board. As a matter of fact, no Counsel appeared. That it was not understood between the Local Board and the Corporation that the latter should have no power to institute differential prices, if and when they thought fit, is certain, because the very point had been the subject of special negotiation, as appears from the minutes of the Southport Gas Committee for Feb. 13 and 15, 1871. As to the statement that the limitation of profit clauses of the General Act of 1847 are embodied in the 1871 Act, the Sub-Committee are advised that Mr. Bellamy has misread the Act, and that the clauses referred to never did apply to the Corporation's gas undertaking.

Mr. Bellamy, it may be remembered, enumerated the conditions which, as he understood, induced the Local Board "to forego their right to manufacture gas in 1871;" and he remarked that, had there been anything like fair adherence to them, the gas question of to-day would not have existed. The Sub-Committee, in reply, reiterate their statement, that the conditions have not been fairly or accurately set forth by Mr. Bellamy. The "gas question," they say, is a result of the action of the Birkdale Council. The conditions laid down in the Southport Improvement Act have not been departed from by the Corporation in any particular. They contend that it was clearly the intention of the Act that the Local Board should enlarge their mains as the district increased, so as to afford facilities for adequate and uniform pressure within the township. This, the Sub-Committee declare, they have altogether failed to do; thereby rendering it necessary for the Corporation, in order to afford the consumers in Birkdale even a moderate pressure to send out the gas at such high initial pressures as are very unfair to the consumers in Southport. On the other hand, large sums of money have been expended by the Corporation in re-arranging their distribution system from time to time, especially with a view to giving a proper supply of gas to Birkdale. But their efforts towards this latter object have been frustrated by the persistent neglect of the Birkdale authorities to increase the capacity of the pipes under their control.

Dealing further with the price of gas, the maximum for which Mr. Bellamy said was raised in 1876 from 4s. to 4s. 6d., the Sub-Committee remark that the same authority—Imperial Parliament—which in 1871 fixed the maximum at 4s., thought fit in 1876 to make it 4s. 6d. Up to the present, however, the increase has had no practical importance, as the highest price charged by the Corporation for gas supplied in Birkdale since the passing of the Act of 1876 has been 4s. They found out that the Board of Trade granted a Provisional Order in 1874,

authorizing the Corporation for two years to reduce the illuminating power of the gas to 18 candles, and to charge a maximum of 4s. 3d. It seems that Birkdale was represented in both years.

The question of the illuminating power of the gas next comes under consideration; Mr. Bellamy having stated that "between 1876 and 1880 it was reduced from 20 to an average of about 16 candles when tested with the 15-hole argand burner." The Sub-Committee declare that no such reduction took place. They say they have examined their minutes for the period referred to, but find no evidence whatever of the truth of Mr. Bellamy's statement. It appears that as far back as 1872, there was a difference of 4 candles in the results obtained by Birkdale by means of the 15-hole argand burner and those obtained by Southport by means of a burner suitable for testing cannel gas, as appears from the memorial of the Local Board against the Corporation's application for the Provisional Order of 1874. Thus, instead of a difference arising between 1876 and 1880, it has existed since the passing of the Act of 1871. But putting aside for a moment the question whether the gas has or has not been up to the prescribed standard, it will be manifest, the Sub-Committee say, that the higher the illuminating power, the higher will be the cost of manufacture. Taking the whole period from the passing of the Act of 1871 up to the present time, the amount of profit on the gas supplied to Birkdale has averaged 7·5 per cent. only; and if the last two years are excepted, the percentage falls to about 6·25. If a costlier gas had been furnished, a higher price would have had to be charged for it, unless the Corporation were prepared to supply Birkdale with gas during the whole period at less than cost price, as they actually did during the years 1874 and 1875. In the cost price, the Sub-Committee include the rebate of 8d.

Mr. Bellamy's next point was that "in 1885 the differential prices were adopted—Birkdale consumers being charged 6d. per 1000 cubic feet in excess of Southport consumers," and that this latter change entirely swept away Birkdale's share in the profits of the gas undertaking. The Sub-Committee admit the adoption of differential prices; but they say that up to June, 1893, the difference was only 3d. Since then it has been 6d. They then proceed to examine how far, if at all, the statement is true that the adoption of differential prices swept away Birkdale's share of the profits. They show that from 1885 to 1896 (both inclusive) the Corporation derived £8800 profit on the sale of gas in Birkdale. During the same period, there was paid over to Birkdale £16,347, of which, taking as a basis of calculation 2¼d. per 1000 cubic feet of gas as a fair sum to allow for interest, sinking fund, &c., on mains, there was left to go in relief of rates the sum of £11,339—that is to say, £2539 more than the Corporation received. Mr. Bellamy declared that "by these alterations, all the advantages that were offered to induce Birkdale to forego its rights of gas manufacture have been annulled." The Sub-Committee assert, on the other hand, that Birkdale had no rights to forego; and they say it yet remains to be proved that the authorities have not always had all they were entitled to. In fact, the Corporation have not insisted on their full rights in regard to the price charged for gas.

The Sub-Committee now come to the proposal of the Corporation to lower the illuminating power, which Mr. Bellamy said would really bring it down "from 20 to 14 candles—a difference of 30 per cent." They remark on this point that if the 15-hole argand burner be used as the standard, this is possibly correct; but, taking the quality of gas actually supplied, which has been sent out of the works at about 21 candles, as tested by the Silber argand, the proposed reduction to 15 candles (which practically means the gas would be sent out of the works at about 16 candles), as ascertained by the "London" argand, is about 3 candles—that is to say, a little over 15 per cent. With regard to the cost of enrichment beyond 16 candles, which Mr. Booth, the Gas Engineer to the Corporation, had shown to be ¾d. per candle, Mr. Bellamy, it may be remembered, thought it must be "more economical to enrich the gas to 20 candles, seeing that candles above 16 cost just one-half those below." Assuming the cost of enrichment for the first four candles above 16 to be at the rate of ¾d. a candle, the Sub-Committee acknowledge that Mr. Bellamy's reasoning is perfectly accurate. In practice, however, it has been found that consumers do not use proper burners. As he himself pointed out in a lecture which he delivered in Liverpool about two years ago, this is all the more emphatically true when the gas is cannel gas, as "there is great difficulty in obtaining a burner suitable for gas of higher illuminating power" than 16 candles. Moreover, he considers that "within a reasonable time a high quality of gas may be unnecessary for any purpose."

The proposition of the Gas Committee being to lower the illuminating power to the extent, according to Mr. Bellamy, of 30 per cent., he thought the maximum price of 1871 (4s. per 1000 cubic feet) should be reduced to the same extent—viz., to 2s. 10d. The Sub-Committee point out that the maximum of 1876, which superseded that of 1871, is 4s. 6d.; and assuming they are entitled to use the Silber or the Sugg "G" burner, the proposed reduction of illuminating power amounts only to 3 candles—a trifle over 15 per cent. Now, 15 per cent. off 4s. 6d. is about 8d.; so that on this basis the maximum should not be reduced to less than 3s. 10d. The Committee's proposal is that the maximum should be fixed at 3s. 9d. Mr. Bellamy said he thought "the best burner would be a good flat-flame burner of the type suitable for general and domestic lighting." The Sub-Committee point out that as recently as 1894 the comparative merits of argands and flat-flame burners were thoroughly gone into by the Committee on the Preston Gas Bill of that year, with the result that it was decided that the argand was more suitable for testing purposes, and should be substituted for the flat-flame, which up to that time had been the prescribed burner in Preston.

The remaining questions dealt with by the Sub-Committee refer to differential charges and limit of profits. In regard to the former, Mr. Bellamy told the Birkdale Council that "it must be borne in mind that equal prices were offered to Birkdale in 1870 for the specific purpose of inducing a relinquishment of their manufacturing powers, and must therefore be regarded as part of a bargain which must be rigidly adhered to." The Sub-Committee reply: "To ascertain the terms of the bargain, reference must be made to the Southport Improvement Acts; and there nothing will be found on the subject of differential prices. . . . If the gas had been supplied in Birkdale at the same price as that at which it has, as a matter of fact, been supplied in Southport, the Corporation would have made very little profit on the Birkdale supply, taking the whole period through." Mr. Bellamy went on to say "the limitation of profits . . . is one of the most important in the interests of the Birkdale consumer. . . . The importance of this matter is most readily shown upon reference to the parliamentary returns relative to gas undertakings for 1895." The Sub-Committee say on this point that, in taking the year 1895 as the basis of his remarks upon the subject of the limitation of profits, Mr. Bellamy has taken a year which was a record one in the history of the Corporation gas-works. His remarks were, therefore, misleading. The Corporation did, undoubtedly, make large profits in 1895. It would have been equally misleading if he had taken the year 1875, when the Corporation lost £551 on the gas supplied to Birkdale, or 1874, when the loss was £454. They say it must be obvious that the only fair and sensible test is the average profit derived during the whole period—that is, from 1871 to 1896. This, as already intimated, is only 7·5 per cent. The limitation imposed by the General Act of 1847 does not apply to Southport; and even if it did, before the limit thereby prescribed—viz., 10 per cent.—was reached in respect of the gas supplied to Birkdale, the Corporation would be entitled to receive an additional sum of £12,000 for past deficiencies—in other words, to make up "back dividends." It seems to the Sub-Committee that a limitation of profits might be more gracefully and forcibly urged when the average for the time being has reached a higher water-mark.

With the two points above dealt with settled, Mr. Bellamy thought the further questions of illuminating power and the form of standard burner would probably settle themselves. The Sub-Committee remark on this that if the points referred to are to be brought forward on the present occasion on behalf of Birkdale, there are others that must be raised on behalf of Southport, such as the amount of rebate repayable under the Act of 1871, and the question of the mains. In their opinion, all points of difference might well be discussed by the two bodies. Mr. Bellamy, in the course of his report, stated that, in 1886, Birkdale opened negotiations with Southport with the object of a settlement, and offered, without success, to adopt the Gas Referees' standard burner for 20-candle gas. The Sub-Committee remark, in reply, that the negotiations referred to took place in 1888; and that Mr. Bellamy omits to mention that his clients declined to accept the burner which Parliament subsequently sanctioned for testing the gas in Preston. As a matter of fact, it is well known, they say, that when the Referees prescribed a burner of the flat-flame variety for 20-candle gas in the Metropolis, there was no argand burner available for testing gas of that quality.

In conclusion, the Sub-Committee recommend that a further attempt be made to discuss and settle the gas question with the Birkdale District Council.

The Sub-Committee's reply was appended to the minutes of the Gas Committee presented at the meeting of the Town Council last Tuesday, and adopted. It should be recorded, however, that the Sub-Committee were not unanimous; one of the members presenting a short report on his own account.

Local Government Board Inquiry.

Last Friday, Major-General H. D. CROZIER, R.E., held an inquiry at the Town Hall, Southport, on behalf of the Local Government Board, respecting an application by the Southport Corporation for a Provisional Order to amend the Southport Improvement Acts of 1871 and 1876, so as to provide: (1) That the illuminating power of the gas supplied by the Corporation shall be reduced; (2) that the method of testing such illuminating power shall be altered; and (3) that the maximum price per 1000 cubic feet to be charged for such gas shall also be reduced. The first portion of the inquiry was devoted to the consideration of an application by the Corporation to borrow £12,000 for electric lighting purposes, after which the gas matters were proceeded with.

The TOWN CLERK (Mr. J. D. Williams) appeared for the Corporation; and Mr. HORRIDGE watched the proceedings on behalf of the Birkdale District Council.

The TOWN CLERK, in opening the inquiry, stated that the population of Southport was now 47,243; and the rateable value of the borough was £299,831 for the borough rate, and £294,741 for the general district rate. The total liabilities of the Corporation amounted at present to £695,117.

Mr. HORRIDGE at this point made an application for the inquiry to be postponed.

The INSPECTOR said he had not power to order a postponement.

Mr. HORRIDGE replied that he had received a letter from the Local Government Board, stating that the Inspector had the power to defer the matter.

The INSPECTOR said the inquiry must go on; but he would make a note of Mr. Horridge's objection.

Mr. HORRIDGE stated that this was an exceptional case. In the first place, the application was to alter the Act of Parliament between Birkdale and Southport. The whole basis of the inquiry was as to the meaning of section 35 of the Act of 1871; and the Divisional Court had decided what were the rights of Southport and Birkdale under that Act. The section referred to described the quality of gas that was to be supplied by the Southport Corporation. It was to be of such illuminating power as to produce, from an argand burner having 15 holes and a 7-inch chimney, or other approved burner, a light equal to 20-candle power; and the question of testing turned upon the words "other approved burner." The Divisional Court decided that the Corporation were not bound by the 15-hole argand burner. The effect of this decision was practically this: That science had advanced, and burners had improved; and we will give you what is a modern burner, which will produce light of 20-candle power. This, of course, made all the difference; and the Birkdale District Council held that it was impossible for the Local Government Board to fix what was a fair method of testing. They must take into account the fact that the Act of Parliament fixed the 15-hole argand burner; and they must say what was a

fair modern equivalent; and then the Act must read, "or other modern approved burner."

The INSPECTOR: This matter was decided by the Divisional Court.

Mr. HORRIDGE: Yes; and it is the subject of an appeal by Birkdale. Proceeding, he remarked that both Judges said they hoped the matter would come before the Court of Appeal; and now Southport was seeking, before that appeal was settled, to alter the standard which they had to apply to the candle power. It seemed most objectionable to go for a Provisional Order before they knew what was the meaning of the original Act.

The INSPECTOR: You are only talking about Birkdale. Supposing the Provisional Order does not apply to Birkdale?

Mr. HORRIDGE said they would then be altering the bond made by the Act of Parliament. It was a most important question. Birkdale had got an Act of Parliament, the purport of which was that there should be one gas authority to supply the same gas to Birkdale as to Southport, at a certain fixed price. If Birkdale were excluded from the Provisional Order, they would be in the position of having made a bargain without an audit clause or a limitation of profit clause, which was the usual thing when one authority supplied another.

The INSPECTOR said that unfortunately he was only an engineer, and was sent there to get the facts upon which the Local Government Board must decide whether they had power to entertain the application of the Corporation. He was not there to interpret the law.

Mr. HORRIDGE: This notice was sent to us on Jan. 7 for the first time; and we did not get a copy of the application until last month.

The INSPECTOR remarked that Southport ought certainly to have told Birkdale

Mr. HORRIDGE said he should ask that all the witnesses should be recalled for cross-examination, because he declined to cross-examine them until he had fully gone into the matter.

The TOWN CLERK: You knew of this application six weeks ago.

Mr. HORRIDGE: The application was made on Nov. 30, and the notices were not published until Dec. 31.

The TOWN CLERK: As soon as we got them.

After some further discussion,

The INSPECTOR said he would make a note of the point raised, and see if the authorities were in default. The basis of the application was a wish to reduce the illuminating power of the gas; and the remainder of the things asked for followed.

The TOWN CLERK (proceeding) said they were prepared to assume that the light supplied was to be 20-candle power by the section; and they wished to have it reduced to 15 candles. It did not matter in the least what the High Court might say on the subject, so long as they got one clause substituted for the other; and the only question of any difficulty at all—though he did not think it a very great difficulty—was that of maximum price, which could be determined by the Board of Trade return of gas undertakings throughout the country. If the Birkdale people did not feel prepared to come in and join them in this change of the Act of Parliament, the Corporation did not wish to coerce them; but they would reduce the application to the borough of Southport and the district of Ainsdale, thus excluding Birkdale from its purview altogether. His learned friend said they had another grievance—they had certain rights under the Act of 1871. His answer was that they did not care what the rights of Birkdale were. Southport was quite prepared to give them such rights in full; but they wanted to get their own rights under the Acts of 1871 or 1876. In other words, if the Birkdale authorities did not wish to come in on this occasion, whatever their legal position was under the Act of 1871, they wished that position to remain intact; and he wanted to know what Birkdale could ask for more than that. If Birkdale, on the other hand, were prepared to reserve judgment on the propriety of this application being made at all, until they had heard his case on behalf of Southport, he should be very happy to open for the whole area. Otherwise, he would confine his observations to the case for Southport and Ainsdale alone.

Mr. HORRIDGE intimated that he had not had time to get up his case.

The INSPECTOR: It seems to me that Birkdale has only to make up its mind one way or the other. Will you come into the Provisional Order, or will you keep out of it?

Mr. HORRIDGE: With great respect, no. It is a very insidious way of putting it, which, when you read the sections of the Act of Parliament, you will see is placing an entirely different construction upon it. I am not in a position to cross-examine until I have expert evidence on my own side.

The INSPECTOR: Birkdale should have thought of this before. I do not think these things could go on without being known; and the statutory notice was given.

Mr. HORRIDGE pressed his objection against the insufficient notice of the inquiry.

The TOWN CLERK said he thought the suggestion he had made, if it could be carried out, ought to meet the requirements of the case. Their friends on the other side were evidently not prepared to intimate what the course was that they would pursue; so that he supposed the more convenient method at the present juncture would be to open first for the whole area, and then to show what it was proposed should be done in the event of any opposition being offered from Birkdale. Before he came to the proposed amendments to the Act of Parliament, he would briefly deal with the history of the matter up to the present time; and he would also give a statement which would, he thought, show fairly accurately how the matter now stood. The gas-works were established as long ago as 1850; and from some time in the sixties down to 1871, they supplied gas not only within the statutory area of Southport, but within the district of Birkdale by agreement. There were new works erected in 1871; and increased borrowing powers were obtained. The area of supply under the Act of 1871 was very considerably enlarged; being extended to a point within a radius of six miles from the Town Hall. Under this clause, they took in Ainsdale, which he did not think was supplied before 1871. The illuminating power of gas supplied throughout the whole area was governed by section 35; but he was afraid it was a very badly drafted Act. They would find in this section the very curious circumstance that, although it stated 20-candle power, by the literal interpretation of the section their obligation was 1-candle gas. The draftsman had left out the word "each;" and the statutory obligation was strictly 1 candle. However, he was assuming that it was 20 candles. This was not the only difficulty that the draftsman had put them in. He said that the candle power was to be measured by an argand burner having 15 holes and a 7-inch chimney, or other approved chimney or burner. Though he had put all the burners in section 35, he had left them out in section 38. Altogether, the Act was a curiosity as regarded its drafting. Now, as a matter of fact, Southport had been using one burner and Birkdale another. Southport had been using what they called an "approved burner," while the Birkdale people adhered, with the constancy of affection which did them credit, to the 15-hole argand. Hence the difference in certain results of the testings from time to time. Under the Act of 1871, the pressure was not prescribed at all; but, as a matter of fact, they supplied the gas consumers at an actual pressure at the works of 25-10ths during the hours of maximum consumption, and during other hours at 15-10ths. It was very interesting to compare this with the statutory obligations of the London Gas Companies. Section 34 of the City of London Gas Act of 1868 specified a pressure from midnight to sunset of not less than 6-10ths, as compared with Southport's 15-10ths. They supplied gas at a pressure—and he thought he was correct in terming it an initial pressure—at the boundary of Birkdale of 20-10ths. What happened to the pressure after it entered the Birkdale district, was somewhat disastrous, as proved by certain automatic tests made. With reference to the mains, they had in Southport at the present time 111,244 yards; and in Birkdale they supplied gas through 27,676 yards. The capital authorized by the 1865 and 1871 Acts was about £59,000. By the 1876 Act, however, it was increased by £230,000; thus making the total capital sanctioned by Act of Parliament, £289,000. Of this, they had expended some £200,000. The present capacity of the works was 2¾ million cubic feet. The actual supply in Southport last year, to 7676 customers, was 273,867,800 cubic feet, which was equivalent to 81·97 per cent. of the whole; to Birkdale, with 1615 customers, 57,993,300 cubic feet were supplied, or equal to 17·36 per cent.; and to Ainsdale, where they had 97 consumers, they supplied 2,240,600 cubic feet, equal to 0·67 per cent. This was for the year ending March, 1896. With regard to the maximum price authorized to be charged, he wished to quote first of all section 30 of the Act of 1871, which stated that it was not to exceed 4s. per 1000 cubic feet. This was the maximum for the whole of the area of supply, only so far as Birkdale was concerned they had taken that off by section 43, which allowed the Birkdale authorities, immediately the gas was sold, 8d. per 1000 cubic feet. One reason why he referred to this was to show that it did not matter what was the quality of the gas, as the section only dealt with the quantity supplied. If they sold 1000 feet of gas to a consumer in Birkdale, it did not matter what the quality was, they immediately became liable for 8d. to the District Council. With regard to the public lamp supply, the Birkdale authority could, under section 42, either pay £2 2s. per lamp, or they might have a meter, and choose to be charged 3s. 6d. per 1000 cubic feet. When the price of gas was increased, they, as wise administrators, chose the £2 2s.; and when it came down, they sought the second alternative. The next section he would refer to was section 24 of the Act of 1876, under which the price was raised throughout the whole area. It did not affect the public lamps in Birkdale; but the maximum price of gas to private consumers was raised from 4s. to 4s. 6d. per 1000 cubic feet. He might mention, in passing, that, although this was done under section 24 of the Act of 1876, it never operated, and they had not charged 4s. 6d. In other words, the section was practically a dead letter. Subsequently, Southport obtained a Provisional Order from the Board of Trade authorizing them to raise the price of gas from 4s. to 4s. 3d. per 1000 cubic feet, and reduce the illuminating power from 20 to 18 candles.

The INSPECTOR: What was the object of that?

The TOWN CLERK replied that it was on account of the increase in the price of coal. It was operative for two years. He might say that reduction in illuminating power was no new thing. At Glasgow, the illuminating power was reduced about four years ago, and they might be aware that the principal London Gas Company in 1892 ceased to supply 20-candle gas; and all consumers within the Metropolitan area were at the present time supplied with gas of 16-candle power.

The INSPECTOR asked what was the power of the gas in the South Metropolitan area.

The TOWN CLERK said it was about the same as in other parts.

The INSPECTOR: I think the gas people should supply new eyes to their customers.

The TOWN CLERK (continuing) referred to the report in connection with the reduction of the illuminating power of the London gas. He stated that one of the reasons of the application was that, in consequence of the increasing use of gas as fuel, it had rendered a high illuminating power unsuitable for ordinary purposes, while the improvement of the burners had tended to raise the efficiency of the illuminating power. This was their position as compared with other companies. The Board of Trade returns stated that the total number of companies and corporations supplying gas in this country was 574. In regard to the quality of gas supplied, Southport held a unique position; for if they took their illuminating power at 20 candles, they would not find any other corporation supplying such high-power gas.

Mr. HORRIDGE: I think you take it the wrong way. They may supply; Liverpool is a case in point.

The TOWN CLERK said in Liverpool it was a Company that supplied the gas.

The TOWN CLERK (continuing) said that the companies supplying 18-candle power gas were 3 in number, and the local authorities 5; at 16½ candles there were no local authorities, and only one company; at 16 candles 23 companies, and 20 authorities; and at 15½ candles there were two companies and no local authorities. When they came to 15 candles, they found there were 123 companies, and 39 local authorities; and at 14 candles there were 240 companies, and 72 corporations. They would see therefore that the bulk of the companies and local authorities had an illuminating power of 14 or 15 candles. It was clear therefore that Southport was standing in an anomalous position. But, though their obligation was 20 candles, they had been sending out gas of 21-candle power all through the year on an average; and by experience they had found that the evil of suppiying such quality of gas was this: That it was

not appreciated, because the burners used were unsuitable for its consumption. There was another consideration which applied especially in winter. In that quality of gas—which he would call cannel gas, to distinguish it from 16-candle gas—the hydrocarbons were more sensitive to the action of cold. The burners that were used by the consumers were altogether unsuitable for burning gas of the rich quality supplied. As long ago as 1871, this was pointed out authoritatively in a report to the Board of Trade. For three years a Committee sat on this subject; and they examined some hundreds of burners, which showed some very curious and interesting results. They made the statement that, by using good burners instead of bad ones, consumers might obtain from 30 to 50 per cent. more light, and their gas bills remain the same. Other investigations had since been made; and they clearly showed that consumers were not much more careful now than they were in 1871. They had lately taken a few burners from private houses in the town, and made experiments with them. The gas, as tested by the Corporation burner, was equal to 20·33-candle power; but the actual illuminating power given by the ordinary burners tested was: 11·96, 12·6, 11·59, 9·06, 8·46, 8·70, 12·49, and 10·58. This was all the light the consumers got from gas of 20·33-candle power; so that by using the burners they did, they only really obtained a little more than half the illuminating power supplied. He was not going to argue for a moment that under proper conditions 15-candle gas was equal to 20-candle gas; but he was prepared to suggest that, seeing the casual way in which consumers would persist in purchasing their burners, they frequently obtained better results with the lower-power gas. The price of these burners, he believed, was very small—an argument the ordinary consumer would never be able to resist. The Corporation had done their level best to use the proper burners. They had for years expressed their willingness to give the right type of burner—the steatite batswing—away for nothing; and yet people had not gone to the trouble to avail themselves of the privilege. Last year, they obtained a Provisional Order authorizing them to borrow money for the sale and hiring out of gas-stoves. This matter might be fresh in the mind of the Inspector, because he held an inquiry relating to the application. At the present moment, the number of people in Southport, Birkdale, and Ainsdale using gas for cooking and heating was about 1500. For these purposes, gas was sold at a lower rate; the reduction being 6d. per 1000 cubic feet in Southport and Birkdale. So that, with a maximum possible charge of 4s. 6d. per 1000 feet, they sold their gas to Birkdale at 3s. 4d. per 1000 feet for lighting, and 2s. 10d. for heating. There were some 5000 incandescent lights within their area. He should also mention the 8d. rebate allowed Birkdale, which brought the price for lighting purposes down to 2s. 8d. per 1000 feet.

Mr. Horridge: Not altogether, because Birkdale provides the mains; and except as to 2d. of the rebate we get no benefit from this provision of the Act.

The Town Clerk said they disputed that. The point was that the price was to be regulated by the cost; and the cost to the Corporation at the boundary of Birkdale, for all practical purposes, was 8d. per 1000 cubic feet more than in Southport. However, to turn back to the incandescent lights, there were about 5000 used; and the increase in the light was not in direct ratio to the increase in the candle power. In other words, there was a loss of 40 per cent. The regenerative burners had very considerably improved during recent years. They could not say at present that there were a very large number of them in use in Southport; but they knew that, if customers chose to use them, they could get a very high degree of illumination. Under the present circumstances, the consumers did not get the benefit of the high illuminating power sent out. This was the negative aspect of the case; but, in addition to that, the consumers complained there was the positive disadvantage of smoke in their gas. They all knew that different qualities of gas required different air spaces for their proper combustion, and that when gas rich in hydrocarbon was consumed under imperfect conditions it smoked. This also meant loss of illuminating power. Then, again, when they burnt gas of high illuminating power, it had to issue with greater pressure than in the case of a lower quality gas. The 15 or 16 candle gas could be obtained from ordinary coal, without any enrichment—or, at any rate, with very little. The percentage of enriching material used in London was very small. There was no doubt the cost of enriching was very much reduced, owing to the introduction of oil; but it was difficult to estimate the exact cost of producing gas of 16-candle power, compared with that of 20 candles. It could be done by experiment; but whatever the difference was, the advantage would be to the benefit of the consumer. In November, the Corporation passed a resolution which would benefit the consumer to the extent of £1500 a year—namely, to cease charging meter-rents and for fixing same. This also applied to Birkdale. The question of vitiation of the air by the lower quality of gas, was one of which a point might be made; but he thought it would be better to leave that to Professor Lewes, who was an authority on the subject. He did not know that the London air was affected by the gas. A cubic foot of 20-candle gas would take from the earth more oxygen than the same amount of 16-candle gas; but how much depended upon the quantity of sulphur in the gas. It was interesting to compare their record with the London gas. In London, in the summer they allowed 17 grains of sulphur per 100 cubic feet; and in the winter, 22 grains. The quantity of sulphur in the Southport gas in winter was about 8½ grains per 100 cubic feet. As to the clause which they proposed to alter if Birkdale would join them, he saw that in the first place the reduction would be nominally from 20 to 15 candle power. The clause at present was as follows: "All the gas supplied by the Corporation within the township of Birkdale shall be of such illuminating power as to produce, from an argard burner having 15 holes and a 7-inch chimney, or other approved burner and chimney, or burner consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by 20 sperm candles of six in the pound burning 120 grains per hour." The altered clause would read: "All the gas supplied by the Corporation, or within the township of Birkdale, shall be of such illuminating power as to produce from a Sugg's 'London' argand burner, No. 1, with a 6 in. by 1 in. glass chimney (but so long as the gas-flame rises above the top of the glass, a 6 in. by 2 in. glass chimney shall be used), or any other burner or chimney approved by the Board of Trade on the application of the Corporation, consuming 5 cubic feet per hour, a light equal in intensity to the light produced by 15 candles of six in the pound, burning 120 grains per hour, or such other equivalent light produced in such a manner as may be approved by the Board of Trade on the application of the Corporation." At present they used the Silber argand; and he thought there would probably be a difference of two candles between that and the "London" argand.

The Inspector: You substituted the Silber argand for the 15-hole argand?

The Town Clerk: I do not think we ever used the 15-hole argand.

Mr. Horridge: You must have, because the Silber argand did not exist until 1874.

The Town Clerk (resuming) observed that, where the Silber argand would show 21-candle power, the "London" argand would only show 19. Therefore, inasmuch as they would have to send out gas of at least 16-candle power, the actual reduction would be only 3 candles, owing to the difference between the two burners. He had gone through a number of Acts of Parliament; and the burner generally used for gas of that quality seemed to be the "London" argand. It was the burner selected by the Gas Referees, under the Gas Acts of 1868, for testing London gas of 16-candle power. The Corporation wished to be in a position to apply to the Board of Trade for a better burner than the "London" argand, should one come out. With regard to burning 120 grains an hour, for an equivalent light produced in such a manner as might be approved by the Board of Trade, he explained that a Photometrical Standards Committee, appointed by the Board of Trade in 1881, presented a report in which they stated that they had tested a very large number of candles, and found the variations on an average to be 15 per cent. between one candle and another, while between two pairs of candles, the variation was in some cases 27 per cent. From that day up to the present time, the candle had been regarded as an erratic commodity. Of course, no one had ever seen the ideal candle contemplated by the Act of Parliament. The same Committee presented another report in 1895, on the standard to be employed for testing the illuminating power of gas. They said: "The method at present in use for measuring the illuminating value of coal gas, consists in comparing the light of gas when burning from a particular burner at a specified rate, with the light of a sperm candle burning also at a specified rate, which last is taken as a standard. We have satisfied ourselves that the flame of a sperm candle does not furnish a satisfactory standard, by reason of the amount of light which it affords varying over a wide range under conditions as to the manufacture of the candle, as to its mode of use, and as to adventitious circumstances attending its use, which as a whole it is not possible to regulate and define." The recommendation of the Committee was: "That a pentane air-flame, furnished by the Dibdin argand burner, having the form and dimensions set forth in the appendix, and used in a manner there defined, be accepted as giving the light of 10 standard candles; and that this flame be authorized and prescribed for official use in testing the illuminating power of the gas supplied by the London Gas Companies." The Committee had arrived at this decision after three years' inquiry, and after making an enormous number of tests. The ground on which the Corporation asked to amend the Act of 1871 was that they had been advised not to supply gas of so high an illuminating power, involving as it did an expenditure of money not giving a corresponding advantage to the consumer; and they were asking to be placed in the same position as other companies, when they could consider as to how far they would avail themselves of the power granted to them. If they obtained the Provisional Order, it would be certain to impart elasticity to the purchase of coal; and they would in consequence have a far wider field open to them for obtaining their necessary supply. With reference to the alteration in section 24 of the 1876 Act, it was that 3s. 9d. per 1000 cubic feet should be inserted as the maximum price in lieu of 4s. 6d. The ground for the alteration was, of course, that, with the proposed reduction of the illuminating power, the maximum of price should be proportionately reduced. A return of the maximum prices charged by gas undertakings throughout the country supplying gas of about 15-candle power, showed that 141 authorities were in the happy position of having the illuminating power fixed at either 14 or 15 candles; but no maximum price was prescribed. When they came to those which had a maximum price, they found that it ranged from 3s. to 7s. 6d. per 1000 cubic feet; the list being compiled from the Board of Trade returns.

At this point,

The Inspector intimated that he would sit again on the succeeding day (Saturday); and a discussion then followed as to the advisability of resuming the inquiry in February.

The Town Clerk said the longer the adjournment the better the opportunity was for the two bodies to meet and discuss the question. Resuming, after lunch, he gave certain particulars regarding the manner in which Birkdale was supplied at present. They supplied the township at three points, although there was no obligation upon them to do this. Up to 1871 gas was only supplied at one point; but for the convenience of their customers in Birkdale, they supplied the township at three. At one point, the Corporation had a 20-inch main, which discharged into a main in Birkdale of these dimensions: Diameter, 10 inches; area, 78·54 inches. Another main of the Corporation was 14 inches in diameter, which connected with a Birkdale main of 6 inches, with an area of 28·27 inches. The third Southport main had a diameter of 10 inches; and this coupled on to two mains—one of which was 6 inches in diameter and the other 4 inches. They had taken certain tests of the pressure; and he would like to convince their Birkdale friends that there was an automatic device for taking the pressure. The pressure was not worked out in any way; it was obtained by means of an automatic recording machine. At Cemetery Road, on a given day, the pressure was 19-10ths; and in Eastbourne Road, with a 10-inch main, it had only suffered 3-10ths—being dropped down to 16-10ths. In Liverpool Road, however, where there was a 4-inch main, it had actually dropped down to 12-10ths. Without going any further, that was on the face of it a serious drop in this distance. The Inspector would be aware that, in passing through the meter, the gas would again suffer loss of pressure; and he believed it amounted usually to about 2-10ths. That would bring it down to 10-10ths; but it might suffer to the extent of 5-10ths if the drum was rather stiff in working. In

that case it would be reduced to as low as 7-10ths. In addition to this, supposing there were several lights drawing on the pipe in which the pressure after passing through the meter was 7-10ths, or any other figure, the pressure given to any one of these lights would be reduced. He was not therefore surprised that Birkdale consumers complained from time to time. On the other hand, it was quite certain, and he was bound to state it emphatically, from all the evidence they had got, and advice which they had received on the subject, that to send out gas from the works at a pressure which would give nearly 20-10ths at the boundary of Birkdale was not fair to their own consumers, because although, when a private company were dealing with the matter they were not particular as to whether they sent up the bills of the consumers, he thought the Corporation would not go on such lines as these. In fact, if they took the actual profits which the Corporation made, it would be seen that they had not been realizing so much money by a very long way as private companies in Lancashire. Continuing, he said they were not going to depart from the agreement of 1871 but if they were asked to express an opinion upon it, they would say that from one point of view it was not a fair one, because there was the maximum. But there was such a thing as putting the "last straw" on the "camel's back." Taking the provisions with reference to mains in the Act of 1871 as they stood, they were in this wise: The Birkdale authorities had the power of laying all the mains and pipes within their district; but they had not the obligation to do it. There was nothing in the Act which imposed upon the District Council of Birkdale any obligation to help the Corporation in any way whatever in the development of the gas undertaking; and he supposed the Corporation could not complain of it because it was in the Act. The District Council had the exclusive right of laying gas mains and services in the township; but beyond having the use of them for the gas supply and connecting their services, the Southport Corporation had nothing to do with these mains. With regard to the differential charges, there appeared to be an erroneous impression abroad. When the Act of 1871 was passed, the circumstances were as follows: A Company had been formed in Birkdale which acquired a Provisional Order subject to the confirmation of Parliament. Southport lodged a petition against the Order, because they said they had embarked upon a considerable expenditure, on a project for starting altogether new works, with a view of supplying gas to Birkdale under statute. Of course, the Local Board were fully cognizant of the facts, because many members of the private Company were on the Local Board. Southport could not object to the 8d. per 1000 cubic feet rebate, because it was under the Act; but if an equitable consideration was applied, they might claim the help of Birkdale in the matter. If Southport had had their assistance, matters would have been much more satisfactory. Anyhow, so far as Southport was concerned, the bargain so far as mains and the payment of rebate went was anything but a rosy one. They were bound to admit, if the mains in Birkdale were inadequate for 20-candle power gas, it was highly probable they would be inadequate for 16-candle gas, and he said that the time had arrived when Birkdale should enlarge their mains. The district was a growing one, and so was Southport; and they had been compelled to incur very considerable expense in re-arranging their own mains, and laying fresh ones of greater capacity. Birkdale should do the same. It would be interesting to know what they were paying to the Birkdale authorities under the provision of section 43. He believed they had already paid something between £20,000 and £25,000. Of course, they had to take from it the amount Birkdale would expend in keeping their mains in order; but he should think the proportion of 2½d. out of 8d. per 1000 cubic feet, which Southport were paying to them, would cover that. Thus Birkdale were making a good thing out of it; and he had no doubt in idle moments they congratulated themselves upon the fact. The Southport Authority really ought to be selling more gas in Birkdale in proportion to the population than they were; and if they had been rendered proper facilities, they would undoubtedly have been supplying more. Then, going on to deal with the supply of Southport, the clause relating to it was practically the same as the one already sent to the Inspector. Section 38 was only consequential on the alterations in section 35. As regarded the price, under the Act of 1876 they retained the 4s. 6d. per 1000 cubic feet for the supply to Birkdale, and reduced it to 3s. 9d. in Southport. If Birkdale confined themselves to the scope of these clauses, the matter was comparatively simple; but they might desire to open up further questions which were not strictly within these limits, and to disturb generally the bargain of 1871-76. The Southport Corporation had never taken advantage of the position which the absence of any clause limiting profits gave them, or of the fact that there was no prescribed pressure. If the proposed alteration of the illuminating power was not accepted by Birkdale, the District Council could call upon the Corporation to supply them with a different quality of gas; and this the Corporation would do. Though at the present time it might be that the reduction in the illuminating power would be of comparatively little advantage generally, the time might at any moment arrive when there would be something in it; and the Southport Corporation wanted to obtain the power from Parliament, so that when the psychological moment did arrive, they would be able to take full advantage of it.

Mr. *John Booth*, Gas Manager to the Southport Corporation, was then called in support of the application. He said he had followed the applications to Parliament in reference to the candle power of gas during the last 20 years; and he had never known any case in which the standard of Southport was reached, or anything like it. For the production of 15 or 16 candle gas, any ordinary coal was sufficient; but to raise it to a higher quality—say, 20-candle power—they had to use enriching material. Up to a few years ago, they were confined to one particular kind of material for this purpose—namely, cannel—but the richer class of cannel coal fields were becoming exhausted; and about the year 1893, the price went up greatly. He remembered the price of cannel coal rising from 30s. to 55s. per ton; and this increase brought about the introduction of oil for enriching. Healthy competition had ensued between cannel and oil; but were the cannel fields to become exhausted, the competition would cease, and the price of oil would increase. The enriching process imparted a greater proportion of hydrocarbons. For the highest illuminating power, it depended upon the percentage of hydrocarbons, and more particularly on the percentage of unsaturated hydrocarbons, which was the rare material. During great changes of temperature in winter, the cold acted upon the rare and valuable hydrocarbons more readily than upon the constituents of ordinary coal gas. There was less liability to variation in low-power gas than in that of higher quality. It was only last year that they obtained authority to hire out stoves. In 1881, they made a differential charge of 6d. per 1000 cubic feet for gas used for other than lighting purposes; but the public did not take advantage of it then. Last year, they renewed the differential charges; and now 1200 people were supplied with stoves. Fifteen-candle gas would do equally as well as a higher-quality gas for the stoves; and there would be less liability to deposit carbon, &c. The improvement in the regenerative burners had been very considerable during the last year. The burners used by the consumers in Southport and Birkdale would not educe the light which the gas was capable of giving. Flat-flame burners were generally used in Southport. The most suitable one was Bray's No. 4. The No. 4 Scotch brand was also very suitable. The Corporation offered to provide, free of cost, the proper burners; but the consumers had not come forward as numerously as was expected.

The INSPECTOR observed that many irrelevant points had been introduced. What did it matter if the Corporation had bad burners? Such was the case all over England. The point to settle was simply whether they should reduce the illuminating power of the gas.

Saturday, Jan. 16.

On the resumption of the inquiry this morning,

Mr. *Booth* was further examined by the TOWN CLERK. He said that in Southport a growing quantity of gas was being used for heating since the Provisional Order had been obtained sanctioning the sale and hire of gas-stoves. For these purposes, the lower candle power gas would be equally good. The Southport mains had been re-arranged and enlarged from time to time; and if a greater quantity of gas were consumed, the capacity of the present pipes would be sufficient. In the event of Birkdale deciding not to accept the Provisional Order, it was perfectly feasible to give them a supply of higher illuminating gas; but this would mean a large expenditure. The Corporation had a gasholder they could use for the purpose; and they had also the apparatus for carrying out the Peebles process of enriching with oil.

Cross-examined by Mr. HORRIDGE: They began to use oil as an enricher in 1894. In his report for the year ending March, 1895, he mentioned, to show the monetary saving of using oil, that in 1892-3 £11,472 was spent for cannel as against £950 for cannel and £1498 for oil in 1894-5. They did not reduce the price of gas directly they introduced oil as an enricher. He did say in his report: "The gross profit for the year is £23,118; and after paying interest upon loans £5270, and sinking fund £1591, there remains a net profit of £16,256. Of this amount £200 is paid to the reserve fund; leaving for relief of rates £16,056, which is equal to a rate of 14·25d. in the pound." There were reasons, however, which made this exceptional. In that year (1895) they were charging 6d. per 1000 cubic feet more than in the previous year; and they had had a phenomenal increase in the price of gas. The cost of producing gas of 20-candle power last year was 2s. 2½d. per 1000 cubic feet. That was delivered at the consumer's meter; and this price covered the allowance necessary for interest and sinking fund. The price charged in Birkdale was 3s. 6d. per 1000 cubic feet, less 5 per cent. discount. He had made a calculation as to the price per 1000 cubic feet the 16-candle gas would cost. Having taken off the meter-rents, which would, of course, affect the cost of production, the gas would cost to make and deliver 2s. 2d. per 1000 cubic feet. In the price of the 20-candle gas he had included the meter-rents, which would come to about 1d. per 1000 feet. The 16-candle gas only cost 1½d. per 1000 cubic feet less than the 20-candle. One reason for this small difference was that in 1896 the residuals commanded a better price than he had estimated for the current year. In 1896, the by-products realized 6·84d. per 1000 cubic feet, and 8·13d. per 1000 in 1895. He could not say what it had been in the present year. Their experience was that the heating value of 20-candle gas was not considerably greater than that of 16 candles. He had not looked up authorities upon this point, but merely gave his own experience; and this was that, for heating purposes, they got as good results from 16-candle as from 20-candle gas. If they were to give Southport a supply of the 16-candle, and Birkdale the 20-candle gas, they would not have necessarily to make it separately; but they would have to enrich it separately. The works were some three miles from the Southport Town Hall. They would not, of course, attempt to put the 20-candle gas into the 16-candle gas-main. There would have to be an independent main from the works; and this would have to go some four miles before it reached the Birkdale boundary. He had calculated the separate cost of supplying Birkdale in this manner, but not at per 1000 cubic feet. The capital outlay would be £11,000, which would be put to Birkdale's account. They would perhaps get a better light from 20-candle than from 16-candle gas, if they used an incandescent burner; but the improvement was quite insignificant, and would hardly be noticed by the consumer. They did not offer to supply governors with the special burner which the Corporation recommended; and he did not think, by using these burners without a governor, that the consumers' gas bills would go up. They might burn more gas; but to increase the bills was not the Corporation's object.

The TOWN CLERK: Supposing the meter-rents had not been abolished, what would be the difference between the cost of producing 16-candle and 20-candle gas?

Witness: The cost would be practically the same.

The INSPECTOR: That cannot be.

The TOWN CLERK: To me it is absolutely absurd, on the face of it.

The INSPECTOR: The residuals have nothing to do with this. It is the cost of producing gas, less residuals, that should be taken here.

The TOWN CLERK: I am afraid we cannot leave the residuals out altogether.

The INSPECTOR: But they may go up in value as well as go down.

The TOWN CLERK: As a matter of fact, Mr. Booth, if you made this 16-candle gas you would save practically the cost of nearly the whole of your enriching material?

Witness: Yes; practically.

So you see at once that the cost of manufacture could not be the same. Would you not also be able to buy a different class of coal?—Yes; we should have a wider field.

Mr. HORRIDGE: I do not object to your giving evidence in chief, Mr. Town Clerk; but it is a little unfair to suggest explanations in cross-examination.

The INSPECTOR: I have on my notes that the cost of making the two gases is the same, which is a very extraordinary thing.

The TOWN CLERK: There is some mistake here.

Mr. HORRIDGE: The explanation may be that the Corporation are not supplying 20-candle gas at the present time.

The TOWN CLERK: I do not think that is the answer at all. (To witness:) What was the cost of enrichers last year, both oil and cannel?

Witness: I cannot give you the items. We have the coal and cannel together.

How much for oil?—I could not tell you.

Mr. HORRIDGE: Have you not taken the trouble to get the cost out?

The TOWN CLERK: You do not get your enrichers for nothing?

Witness: Of course not.

The TOWN CLERK: Then how can you say the price of manufacture is the same?

Mr. HORRIDGE: This sounds to me very much like cross-examination.

The INSPECTOR: Perhaps it would be better to defer this until the adjourned inquiry. It appears to me that the difference between the cost of the two gases is 1¼d. per 1000 cubic feet.

Mr. HORRIDGE: I am in entire agreement with you, Sir.

The TOWN CLERK: That is not really accurate, I am afraid.

The INSPECTOR: But if you bring up your Gas Manager, and he gives incorrect evidence on a point such as this, what is his evidence worth?

Witness, in further re-examination by the TOWN CLERK, said there were two factors that governed at all times the cost of gas. One was the price paid for material, and the other the amount obtained for residuals. He was quite clear that the sum of 2s. 2¼d. was the cost of the 20-candle gas as delivered at the consumer's meter.

The TOWN CLERK: Well, it's a very startling thing to me. And you sell in Birkdale for heating purposes the gas at ¼d. less per 1000 cubic feet than it costs to manufacture, after deducting the rebate?

Witness: Yes.

Mr. HORRIDGE: And what is the charge for heating? If you do give evidence, Mr. Town Clerk, do not give it inaccurately. The price is 3s., or perhaps 33⅓ per cent. profit, instead of 100 per cent.

The TOWN CLERK: The price of gas for lighting is 3s. 4d.; and a rebate of 8d. from that makes it 2s. 8d.

Mr. HORRIDGE: Oh, no. You have to pay that rebate for the whole area for the pleasure of supplying the gas.

The TOWN CLERK (to witness): You charge in Birkdale 3s. per 1000 cubic feet for heating purposes. Take from that 8d. rebate, and it brings it down to 2s. 4d. Five per cent. off that brings it down to 2s. 2d. Is not that so?

Witness: Yes.

Therefore you supply gas in Birkdale for heating purposes at ¼d. per 1000 feet less than it costs to make?—Yes.

Mr. HORRIDGE: The 8d. rebate ought not to come off at all.

The TOWN CLERK: Ah, that's a point, is it not? (To witness:) With reference to supplying gas of 20-candle power to Birkdale, you have estimated the cost at £11,000. What would that include?

Witness: Alterations at the outlet and inlet of the gasholder, an additional purifier, an extra governor, and the main to the Birkdale boundary.

What distance is that?—About 5000 yards.

Mr. HORRIDGE: Pardon me. It is a matter of simple arithmetic. It is really only some 200 yards short of three miles. Your evidence, Mr. Town Clerk, is really excellent.

The TOWN CLERK: You can then give them any reasonable pressure at the boundary?

Witness: Yes.

And now you have to send the gas out from the works at a pressure that is too high for the consumers living between Southport and Birkdale?—Yes.

Mr. *Thomas Newbigging*, M.Inst.C.E., was the next witness called. He said he had had a large practice in the testing of the illuminating power of gas. He would be inclined to make the standard of gas in Southport 16 instead of 15 candles, as in the Metropolis. That would really mean a supply of 17-candle gas; but 15 candles was the parliamentary standard at the present time. Dealing with the question from a consumer's point of view, he remarked that the burners usually employed were not adapted to the consumption of 20-candle gas; and therefore the consumers did not get the full advantage of it. On the contrary, they burned the gas at a disadvantage, and complained of the quality of the gas—that it was dirty, and "smoked the ceilings." Now this was due to unconsumed carbon as a rule, especially with the higher-quality gas. The variations in quality were more likely to be noticed when high illuminating power gas was supplied. The eye got accustomed to the concentrated light; and whenever there was the slightest variation, it was noticeable. The barometrical changes also affected the gas. He had made an analysis of the Board of Trade returns upon the illuminating power prescribed in various places in the country. There were 574 statutory gas undertakings in England and Wales. He had reduced his analysis to a percentage; and 564 of the 574 undertakings, or 98 per cent., had no prescribed illuminating power at all. They ranged from 16 candles downwards. Southport and Liverpool were the only two gas-works in England and Wales whose prescribed illuminating power was 20 candles. There was no doubt that 16-candle gas could be produced at a lower figure than gas of 20 candles, as very little enriching material would be necessary. In enriching by oil, he would put the cost down at about ¾d. per candle. He had been a gas manager for 20 years. Enriching by cannel used in olden days to be 1½d. per candle; now it was ¾d. by oil. By reducing the illuminating value four candles the saving would be four times ¾d., which was 3d. per 1000 cubic feet. Unscreened coal would do for the lower quality of gas, and would cost 6d. or 9d. less per ton than the other coal. With respect to gas for purposes other than lighting, he said the higher illuminating value had no doubt a higher calorific power. But it was rarely, or never, consumed to advantage; so that taking the ordinary way of burning gas by consumers, he did not think there would be any difference in the value of the two. The 16-candle gas would as a rule be properly burnt; and therefore it would be equal to the other, and there would not be the same disadvantage as regards the deposition of carbon. This deposition frequently happened with the higher qualities of gas in the cylinders of gas-engines; and with cooking apparatus, it would probably get on the food. His experience enabled him to say that there was imperfect combustion with high-quality gas, and especially with that of 20-candle power. In rich gas there was a larger proportion of carbon, in the shape of hydrocarbons; and to consume it properly, required a larger supply of oxygen than if it were of 16-candle power. Therefore, volume for volume, there would be a greater abstraction of oxygen from the atmosphere. That was to say, so far as the vitiation of the air was concerned, there was less carbon in the lower quality of gas, and it required less oxygen to consume it, bulk for bulk. In all gases there was a proportion of sulphur which was not eliminated in the process of purification; and this varied in different towns. In Southport, the amount of sulphur was exceedingly low; being 8¼ grains per 100 cubic feet. Now assuming that there were four burners in a room, each consuming 5 cubic feet of gas, the amount of sulphur given off from the flames would be something like 1⅞ grains per hour, which was not worth considering. If it was three or four times that quantity, it would be deleterious to health. In London, the prescribed limit was 17 grains per 100 cubic feet in the summer, and 22 grains in the winter; so that London gas, assuming it was supplied to the limit in the winter, would contain nearly three times as much sulphur as Southport gas. If there was an increased quantity of the lower illuminating gas demanded, he was of opinion that the mains in Southport were of sufficient capacity, because, according to the tests at the extremity of the mains, there was a pressure of 20-10ths, which was a very great pressure to be at the end of a main. It was really a good initial pressure. There was, therefore, a very large margin of area in the present Southport mains. His view of the maximum price—which was also the view that Parliament took—was that there was no necessity to be very particular about the sum of the maximum. There should be a reasonable margin beyond the selling price, so as to provide for contingencies, such as the increased price of coal; and 1s. was regarded as a fair margin. He thought the maximum price in Southport should be 4s. per 1000 cubic feet, and not 3s. 9d. The maximum price was not like a standard, where they had a sliding-scale. He thought the Birkdale mains were too small; certainly the trunk mains were. He agreed with Mr. Booth that it was possible to give a separate supply to Birkdale, if the Order was made for Southport and Ainsdale only; and the cost he (Mr. Booth) estimated was enough. But he did not think it would be wise to do this. It would be far better if Birkdale would fall in with Southport, and advocate the reduction in the quality of the gas. Respecting the diffusion of the rays of light from 16-candle gas, as compared with that of 20 candles, he said there had been a good deal of discussion upon this question of late years. Some argued that illuminating power and illuminating effect were two different things altogether. Although a gas might have a high illuminating power, as indicated by the photometer, yet the effect of the illumination given by it would be no better than that of a lower quality gas; and that was an opinion which he, among others, held. In using the lower quality gas, a larger flame was required; and thus from a larger surface came a larger number of rays. When the light was concentrated, they had a more sharply defined shadow. They had it in the arc light, in which they had intensity but not quantity. In gaslight, which was the light nearest, in his opinion, to be compared to sunlight, they had quantity as well as intensity. The difference between the Silber burner and the "London" argand burner was 3 candles.

The INSPECTOR: The Silber is an unlawful burner to use.

The TOWN CLERK: Not at all.

The INSPECTOR: I thought an injunction was got against it.

The TOWN CLERK: Yes; but the patent has expired. It was Mr. Sugg who got the injunction.

The INSPECTOR: So that the Silber now exists again?

The TOWN CLERK: Yes.

Mr. HORRIDGE: It is not in the market.

The TOWN CLERK: Yes; it is on sale in Southport.

Witness remarked there was no doubt that the "London" argand was the proper burner to use for 16-candle gas. He believed consumers were more likely to be satisfied if the reduction was made.

Cross-examined by Mr. HORRIDGE: In his table upon the illuminating power prescribed in various places, all the local authorities, with the exception of two, had no limitation in the amount of profits.

But they are not supplying another body?—Oh, yes; they are supplying outsiders.

But in the statistics you have given, there is no audit clause?—Yes; the Gas-Works Clauses Act contains one.

Does it not come to this, that with a private company you have both limitation and audit in every case?—Yes, with the exception of those working under the sliding scale.

When they make a profit of a certain amount, they have to lower the price?—That is so; and they have to get the amount of their profits in each case.

That is private companies. But now in the case of local authorities supplying outside, there would be an audit clause?—I dare say; I am not sure.

The INSPECTOR: Have you got any cases where there are audit clauses in a borough?—I mean outside. The outsiders would not be able to audit.

The INSPECTOR: I have never heard of it. The people generally come begging for the gas supply. Have any of the 157 local authorities audit clauses as regards the supply of outside districts, is what I understand Counsel wants to know?

Witness: I do not think any of them have.

Mr. HORRIDGE: I suppose Lancashire would be a fair average in the whole of England as regards Southport?

Witness: Yes. I have taken out 35 authorities; and I find with the average limitation of 15 candles the actual illuminating power supplied is 18·3 candles?—I would not admit the actual. I might admit that this was the return. But I should almost question whether you are correct.

But assuming my figures are correct?—I don't think I could assume that. (Laughter.) There are a lot of authorities supplying about 17 and 16 candles.

You must, when you get above 16 candles, employ enrichers; and therefore the result is that in the bulk of these places in Lancashire they find it advisable, rightly or wrongly, to use enriched gas?—They do; but most of the Lancashire gas coal will produce better gas than 16 or 17 candles.

Given a suitable burner and the same conditions, do you say you do not get a corresponding advantage in light by 20-candle power gas, as compared with 16 candles?—No, I do not say that. You do undoubtedly.

Do you get a considerably better result when once you get the enriched light between 16 and 20 candles?—No, but you get a better result if it is properly consumed.

Supposing with your burner and the same conditions I put in my last question, which is the more healthy?—In that case I shall agree with you that the higher quality (the 20 candles) is slightly the better. I would not admit that there was much difference. It would be undoubtedly in your favour.

Assuming your Corporation to supply a suitable burner and a suitable governor to the stoves that they sell for 20-candle gas, is not the difference in heating power considerable?—There is a difference, but I should also be inclined to say that it is impossible to get a practical burner which will consume 20-candle gas to full advantage. I do not think it is possible unless you use the argand employed in testing.

Does not it come to this, that 20-candle gas is the better illuminating power provided you use proper burners?—Oh, yes.

And cheaper and better to the consumer, provided he uses proper burners?—No, I will not say cheaper.

But you get a greater illuminating power, and it must be cheaper, because you need not use so much?—Well, if it is consumed to advantage it must be cheaper. If the burner is a proper one, it produces less carbonic acid, and is more healthy.

What increased outlay would there be in giving Birkdale a separate supply?—A capital of £11,000 would be required, and it would take 4 per cent. to pay the interest and to allow a sinking-fund to reproduce the capital. This would amount to 1¾d. per 1000 cubic feet.

The INSPECTOR said that would not do, as they were dealing with a Corporation and not a company. They had to borrow money under the regulations of the Local Government Board, and the difficulty was with the sinking-fund. The money would have to be repaid in 30 years—that was the maximum term; but say at 20 years, it would cost 5½ per cent.

Witness remarked that the increase would then be 2d. per 1000 cubic feet for interest and sinking-fund.

Mr. HORRIDGE: What is the calculation as to the extra cost of production from not having been able to buy so well and having separate enrichments?

Witness: It would cost very little more.

To put it in plain English, if Birkdale is left where she is under her statute, the result to Southport under her Provisional Order would be to increase the cost payable by Birkdale whatever it comes to?—Yes, I think there would be a slight increase; and therefore it is far better that Birkdale should go with Southport.

Is not that like compelling them to alter the Act of Parliament?—How do you mean?

Unless you alter it, you will have to pay more. (No answer.)

Can you tell me in Lancashire of any other corporation of the same size and gas consumption as Southport that charges anything like the price which is charged here?—There is not one that has this high quality of gas put upon them.

At Barrow-in-Furness they charge 3s.; but 3s. 6d. is the standard?—They have to supply 14-candle gas, though 20 candles is the professed power. They use the jet photometer, and not the standard photometer.

The standard at Lancaster is 14 candles; but it is given in the returns as 20 candles.

Witness replied that he would like to know how the gas was tested.

Mr. HORRIDGE: Yes, but I have got your parliamentary paper. What is the price of the gas at Lancaster?—It is 2s. 9d.; but there are a lot of things enter into that. (Laughter.) The price of gas in other boroughs in Lancashire is not the question. It was the cost of production to consider. There may be a large capital to pay interest and sinking-fund on.

In Widnes, they turn out gas at 1s. 4d.?—Yes, they do. It is a remarkable affair.

Probably you have been the manager?—No, but I know all about it. They have there a process in use to utilize their tar. They get some remarkable results; but it is a curious thing that nobody can do it but themselves. It has been tried in half-a-dozen places, but none of them have succeeded.

The Southport people have the benefit of the high price of gas in the reduction of the rates; but that does not apply to Birkdale?—Well, they get 8d. per 1000 feet returned. That is a very fair share.

Re-examined by the TOWN CLERK: At Barrow-in-Furness, there is no rebate to an outside authority; otherwise the price would be 3s. 8d. per 1000 cubic feet. The maximum price was 6s.; but assuming that they had to supply a high quality gas, they had a great deal of elbow-room between 14 candles and the quality that they did supply. In many cases, the standard photometer was not used, but the jet photometer was employed. This was liable to get out of order; and not being the standard, he could not accept it as applying to the places referred to.

Mr. HORRIDGE was permitted to put another question as follows: Supposing the Court of Appeal should say that the Birkdale people were entitled to 20-candle gas by the old 15-hole argand, then the reduction is something like 6 candles?

Witness: Ah, yes; then——

Never mind, it would be so?—Yes; it would be so. But if the Court of Appeal say that Birkdale should have gas of 20-candle power, as tested by the 15-hole argand, they would be putting an impossible condition on Southport, because the gas could not be tested by that burner, and the sooner they altered the Act of Parliament the better.

Assuming the Court of Appeal say the 15-hole argand is the best burner, then the reduction is 6 candles, instead of 3 candles?—Well, I will not say that. We cannot test the gas with that argand at all; and I am not prepared to say what the difference is.

But were you not advising the Birkdale Local Board when that very burner was put in?—The burner was put in in 1871. I was advising them in 1876.

Well, you will not give me the difference?—I cannot do it.

The INSPECTOR pointed out that Southport would have to abide by the decision of the Court of Appeal.

Mr. HORRIDGE said that, having regard to the contract, it was absolutely impossible to fairly fix a limit.

The INSPECTOR said it was decided in the Act; and if the Act was abrogated, they must abide by the result.

Mr. HORRIDGE stated that they had one standard for Birkdale and Southport. They wanted to alter the Act of Parliament. Parliament said they must pay a certain price for a certain illuminating power. How could they fix the lower limit of price, until they knew what illuminating power was to be given under the Act for the 4s. per 1000 cubic feet?

The TOWN CLERK: We do not expect that at all.

Witness said that if the Court of Appeal decided on the lines indicated by Counsel, it would mean that gas of very rich quality must be supplied. His arguments against 20-candle gas would apply with still greater force in reference to the richer gas, assuming the Court of Appeal decided that way. Under present conditions, they could not supply the richer gas to Birkdale without giving it to the Southport consumers, whether they liked it or not. Theoretically, the gas could be consumed to advantage; but practically, from actual experience, it was not. He did not know that the Corporation's period of repayment by Act of Parliament was 48 years. That would make his calculation right.

In reply to the Inspector, the TOWN CLERK said that the Corporation had a margin at present of £90,000; and they could raise this sum without going to anybody.

The INSPECTOR said he thought they were under an obligation to go to the Local Government Board for a loan.

The TOWN CLERK replied that that was not so.

Professor *Vivian B. Lewes*, Gas Examiner to the Corporation of the City of London, examined by the TOWN CLERK, said his experience in gas-testing had extended over 17 years. He was familiar with the proposal which the Corporation were making for reducing the illuminating power of the gas at present supplied by them. They were proposing to reduce a 20-candle gas to 15 candles. Comparing the result arrived at by a Silber argand and a London argand, this would mean practically a drop of 3 to 3½ candles. In addition to making the photometrical tests of the Southport gas, he had analyzed it; and the results pointed clearly to it being a 20-candle gas. In the photometrical tests, they used a burner with all reasonable advantages for consuming the 20-candle gas; but as the ordinary consumer's burner was invariably not adapted for burning so rich a gas, there was a considerable deterioration in the light he obtained. These burners were very cheap; and there was very little hope of the ordinary consumer ever being converted from his present habit. The table which had been put in—giving the result of testings made by the ordinary burners in general use—corresponded closely with his experience elsewhere.

The TOWN CLERK: Although we may be sending out this high-quality gas, the consumer is no better off than if we were sending out gas of 16-candle power?

Witness: I can't quite say that.

Supposing you get a very good burner, how much light would you obtain from a 20-candle gas?—From 18 to 18½ candles by using an incandescent mantle; and with the ordinary commercial flat-flame burner, I should say not more than 16 to 17 candles.

And with a 16-candle gas?—You would not get above a maximum of 14 candles.

In London you find almost every conceivable result?—You may go down almost as low as you like; but you never get above 14 candles.

Examination continued: Witness said that if the higher quality was improperly consumed, it undoubtedly sent carbonaceous substances into the air. The low illuminating gas was less likely to vitiate the air; and it was also far less sensitive to changes in temperature. The hydrocarbons they obtained from gas made from coal without enrichment retained its illuminating power far better than gas which had been retorted and then enriched. The richer the gas, the larger was the air supply required; and in order to secure the air supply, pressure was an undoubted factor. His experience of 20 candle gas had been limited; but he did not think they would want a pressure of more than 5-10ths at the point of ignition, and with 16-candle gas a pressure of 3-10ths to 4-10ths. So long as he had his light, the lower the pressure the better for the consumer; for the tendency of a high-pressure supply was to send up the gas bills. In comparing the higher quality gas with the lower quality for heating purposes, there was one undoubted fact which they should remember. They obtained a higher thermal effect from the richer gas if they used the burners adapted to its consumption; but there was one trouble which they could not overlook, and that was the tendency of the flame to deposit carbon upon the substance it might be heating. This trouble was less when a lower-power gas was used. His opinion as to the vitiation of air by the gas, was that it tended slightly in favour of the lower-quality gas. In considering the effect of contracted mains upon a high illuminating gas, they would find that the friction of the pipes, and the change in temperature, would be apt to cause a deposit of more of the illuminating constituents of the rich gas than of the poorer. What he would really recommend was this. They had in London the most perfect organization for regulating the testing of gas. They had also the quality of the coal gas settled after long consideration, and they had the consumers safeguarded in every possible way. They had the Gas Referees carefully

looking after the whole of the changes which took place, and arranging for them accordingly; and he was strongly of opinion that, in a town like Southport, it would be an enormous advantage if they could adopt the London quality with the London regulations.

The TOWN CLERK: That would mean rather more than a 15-candle gas?

Witness: It would mean a 16-candle gas sent out at 16¼ candles.

Mr. HORRIDGE: We should be only too happy to agree with Professor Lewes if we had the London safeguards; but we have neither a sliding-scale, gas referees, or audit of accounts. (To witness:) Supposing you have equally the same conditions, and an equally suitable burner for the same amount of illuminating power, the 20-candle gas is as healthy as the 16 candles?

Witness: I do not quite agree with you there.

But did you not once read a paper to show that the higher you get the illuminating power, the more healthy it was?—Yes, under certain definite conditions, and with certain definite hydrocarbons. But I am speaking upon the Southport gas. Here you enrich with oil; and when that is so, a large proportion of the hydrocarbons are of the saturated series, so that with the higher illuminating power you have also a much larger increase in the proportion of carbon present.

By the TOWN CLERK: When he tested the Southport gas, he found that, so far as the presence of impurities was concerned, they were well within the London limits.

This concluded the evidence to be called for Southport; and the Inspector then adjourned the inquiry till Tuesday, Feb. 9.

WIDNES CORPORATION GAS AND WATER SUPPLY.

The Local Government Board and the Question of the Profits.

At the Meeting of the Widnes Town Council last Tuesday—the Mayor (Alderman Wareing) in the chair—the Finance Committee reported that they had received a letter from the Local Government Board, stating that they had had under consideration the report made by their Inspector (Mr. E. P. Burd), after the inquiry held by him at Widnes on the 11th of November last, in connection with the application of the Town Council, for the issue of a Provisional Order to amend the Widnes Improvement Act, 1867, in respect of the profits arising from the gas and water undertakings of the Corporation; and that, having regard to the strong opposition expressed at the local inquiry to the proposals of the Town Council, and to the long periods allowed by section 30 of the Local Act of 1865, as amended by the Provisional Order of 1886, for the repayment of the gas and water debt, and also to the desirability of keeping down the amount of that debt, the Board were not prepared to issue an Order to make the amendment applied for. Mr. Owens, in moving the adoption of the Committee's minutes referring to this matter, said the strenuousness of the opposition had been an important factor in enabling the august body to whom the Corporation appealed to arrive at the decision recorded. Personally, he had no words of bitterness to offer, nor did he entertain any feelings of resentment. The opposition had gained a victory. He did not begrudge it to them, but rather complimented them on their achievement. Their tactics had been an object-lesson; and possibly at some future time a similar course would be followed. Mr. Barlow seconded the motion. Mr. Shores said he thought the public ought to have full information with regard to the decision of the "august body" to whom Mr. Owens had referred. It should be stated that the Board had expressed their conviction that the present body of ratepayers were not under any disability as regarded either sinking fund or interest appertaining to the gas and water estates; but that, on the other hand, the ratepayers were receiving considerable benefit by the public lighting being defrayed out of the gas profits. The letter was, he added, fully laid before the Finance Committee. Alderman Williamson urged that the letter ought to have been printed *in extenso* on the minutes; and he asked for it to be read. He protested against Mr. Owens' remarks about the "tactics" of the opposition. The tactics were legitimate, and were carried out in a straightforward and fair manner. The Mayor asked Mr. Owens to read the letter. After some discussion, Mr. Owens read the letter, as follows:—

Local Government Board, Whitehall, S.W., Jan. 4, 1897.

Sir,—I am directed by the Local Government Board to state that they have had under consideration the report made by their Inspector, Mr. Burd, after the inquiry held by him at Widnes on the 11th of November last, in connection with the application of the Town Council of Widnes for the issue of a Provisional Order to amend the Widnes Improvement Act, 1867, so that the net profits arising from the gas and water undertakings of the Corporation might be applied in aid of rates. [Mr. Owens observed that this was not part of the application of the Corporation at all.] I am to state that, having regard to the strong opposition expressed at the local inquiry to the proposals of the Town Council, and to the long periods allowed by sec. 30 of the Local Act of 1875 (as amended by the Provisional Order of 1886) for the repayment of the gas and water debt, and also to the desirability of keeping down the amount of that debt, the Board are not prepared to issue a Provisional Order to make the amendment applied for. In connection with this matter, the Board direct me to point out that the present ratepayers are bearing no charge in respect of the gas-works or water-works, either as regards the sinking funds or interest on debt; and, moreover, the district fund appears in fact to be benefited by the cost of the public lighting being defrayed out of the gas profits.

(Signed) C. A. DALTON, Assistant-Secretary.

Alderman Williamson inquired why this letter was not placed on the minutes; but there was no answer. Subsequently, on the Mayor being about to put the motion, Alderman Quinn said he should like to refer to the letter. He believed it stated that the idea of the Committee was that the net profits from the gas and water undertakings should go to the aid of the district rate. He as one member of the Committee, and also of the Sub-Committee, distinctly protested against anything similar to that. It was his farthest thought that the Council should take away from the Gas Committee the whole of their profits; and that portion of the communication was wrong from beginning to end. Alderman Williamson said he should like to know if this had arisen out of the way in which the question had been placed before the Local Government Board. The Mayor replied that he could not tell him. The minutes were then passed.

Gas-Works Extensions and the Price of Gas.

At the same meeting, the minutes presented by the Gas and Water Committee contained the intimation that a special meeting of the Committee would be held on the 19th inst., to consider a letter received from the United Alkali Company, Limited, and also the general question of the price of gas. Reference was likewise made to a report by the Engineer (Mr. Isaac Carr, Assoc.M.Inst.C.E.), accompanied by a table giving the maximum daily make and consumption of gas over the last ten years. It showed that the former has increased from 397,000 to 850,000 cubic feet, and the latter from 413,000 to 901,000 cubic feet; while the total capacity of the existing retorts is but 950,000 cubic feet per diem. The Engineer said it would be seen from these figures that the retort-house extension—the remaining portion of the alterations at the works—which had stood in abeyance for some time past, should now be proceeded with. Alderman Timmis, in moving the approval of the minutes, said, in regard to the extensions at the gas-works, that the scheme had been passed by the Council; and, in accordance with a promise made by the Committee to give the Corporation notice as the separate parts of the work were taken up, he drew their attention to the fact that they were now preparing to proceed with the new retort-house. They were already very close to their maximum make; and if there were a breakdown, or if an increase in the demand took place, they would be unable to supply the necessary gas. Therefore they had decided to go on with the work, which should be commenced now in order that the job might be finished by the end of the year. If the Committee saw reason to change their minds, the work would not be proceeded with. Mr. Davies seconded the motion. Alderman Sadler asked the Chairman of the Committee if he had taken into consideration the threats of the manufacturers of Widnes to make their own gas. If they intended to carry the threats out, he did not see the need of any extension. Mr. Christie also remarked that if the United Alkali Company intended to make their own gas, the Council would not require a new retort-house. Mr. Shores asked whether the Committee had noticed any change in the naphthalene deposits in the mains. In August last, the Committee reported that there were considerable deposits of naphthalene in the mains, which accounted to a large extent for the poor quality of the gas; and the only cause they could assign for the deposits was the recent introduction of the soda process. The Committee proposed to abandon the process, in order to observe whether or not it had any effect upon the deposits. Alderman Timmis said the possibility of gas being produced by other works in the town would be thoroughly discussed. If the Committee found that gas would be so made, the erection of the new retort-house would not be proceeded with. In reply to Mr. Shores, he said the soda process was given up; but the decision of the Engineer was that the stoppage in the pipes was not owing to the process, and it had now been resumed. The Engineer was now, however, putting a solvent into the pipes, with the result that the stoppage was rapidly disappearing. The minutes were passed.

The Public Lighting of Dorking.—A report on the question of the lighting of the streets was lately presented to the Dorking District Council by their Lighting Committee. According to this document, they had experienced (to quote their own words) "great difficulty in coming to any definite and satisfactory arrangement with the Gas Company;" and they therefore recommended that Messrs. Edmundson should be invited to discuss with them the terms on which they would be prepared to enter into an agreement with the Council for lighting the district by electricity. A communication, it was stated, had been received from the Gas Company, in which they made a proposal to fit the public lamps within the district with incandescent burners, and supply and maintain them for 3074 hours at £3 14s. per lamp per annum—the contract to be for not less than five years. This proposal was based on the present charge for gas; and the Council would benefit or otherwise by a rise or fall of price. The Council could not see their way to accept the terms of the Company, which, it was computed, would mean the payment of £119 more than had been provided for in the estimates. It was also considered that a contract for a term of five years would not be fair from the point of view of the ratepayers. The report was adopted.

The Torquay Water Bill.—It is now probable that the Bill promoted by the Torquay Corporation for the improvement of the water supply will pass without serious opposition. A fortnight ago, the members of the Tor Ratepayers' Association discussed the question in a hostile spirit; and there was a fear that they might be found opposed to the Bill. The statutory meeting of ratepayers and owners proved, however, a very formal gathering; and the opposition to the resolution authorizing the Town Council to promote the Bill was represented by only some half-dozen persons, none of whom ventured to demand a poll. The Mayor (Mr. J. F. Rockley), who presided, pointed out that the powers sought under the Bill were permissive, not compulsory. Having obtained authority to purchase the watershed at a cost not exceeding £40,000, the Council might buy the whole or any part of it. If they bought the whole of the 2000 acres of land at a cost of £40,000, the annual sum required for interest and redemption, at sixty years, would be £1600. In 1893-4, when the municipal debts were consolidated, a saving of £2400 was effected in the annual sum payable on account of the water-works; so that if they deducted the £1600, they had still £800 per annum in hand, besides which they would have the land, which it was estimated would produce £400 per annum. Mr. E. Appleton, the Chairman of the Water Committee, said the questions to be considered were how to increase the supply of water, and maintain its high standard of purity. Just at present they had to eliminate the Trenchford Valley water from their supply in time of rain. If they could use that water at all times, they would have an ample supply for many years to come, without expending money on an additional reservoir. Subsequent speakers suggested other means of dealing with the question; but the necessity of obtaining parliamentary powers was generally admitted.

MIDDLESBROUGH CORPORATION GAS SUPPLY.

Complaints as to the Quality of the Gas.

At the Meeting of the Middlesbrough Town Council last Tuesday, the presentation of the minutes of the Gas Committee afforded an opportunity to several members to bring forward complaints as to the bad quality of the gas. Mr. Baker remarked that the defect had been particularly noticeable of late. He had not seen any improvement since the last meeting—in fact, the quality was degenerating. Mr. Forbes concurred. He quite agreed with the statement made that the gas was bad—so bad, indeed, as to render it almost dangerous to walk about. There was a strong feeling in the town on the matter. Alderman Wilson complained that on 'Change that day it had been so dark that they almost had to grope about. Mr. Burrows added his testimony to the gradual deterioration of the gas. Mr. Ward said that when he and other humble members of the Council complained, in fear and trembling, of the quality of the gas, they had always been told by the Chairman of the Gas Committee that they were splendidly treated, and that it was their own fault, in having bad appliances. On this being remedied, however, there was still the same defect—the gas was bad. He was encouraged by the remarks of Mr. Baker, Mr. Burrows, and others; and he expressed the hope that the Chairman would be able to suggest something. Alderman Bell reminded the Council that some months ago he had warned them that this state of affairs was bound to come upon them; and he had, therefore, a mournful satisfaction in replying to the animadversions which had been cast upon him from all sides. He could offer to the Council no kind of hope at all. In the month of May, the Gas Committee laid down a programme which should have been carried out by the month of October. Circumstances compelled him to absent himself from the meetings from May to October; and on returning, he found precisely the same state of affairs as when he left. The Gas Manager (Mr. David Terrace) did, he believed, do his best during his absence to urge upon the Committee the desirability of carrying out the programme. But, for reasons which appeared to the majority of the Committee to be sufficient, the work was left in abeyance; and now they were reaping the consequences. If they had four or five more dark days such as that, he could not undertake to say they would supply any gas at all. The stock was being drawn upon to the full extent in endeavouring to supply the needs of the consumers; and the only way to remedy the matter, and keep the town from absolute darkness, was the one which had been tried on Monday afternoon, when a very slight, but still some, reduction of pressure at the works was made. The result of this had been that a crop of complaints had been received from all sides. When the gas was of poor quality, a very slight reduction either in pressure or in illuminating power was out of all proportion disastrous. The moment he returned, he took means to push on the work which then ought to have been completed. If they had gone on with it during August, September, and October, they would not have been in the position they were now. He might tell them that if they did not before next October provide themselves with an additional half million cubic feet of gas, they would be in an infinitely worse position next winter than they were this. He could only urge the Council to carry out the programme laid down two years ago, which provided that by the autumn of 1897 they would be able to send out a million cubic feet of gas per day in addition to their present supply. The only method they could adopt to enrich the gas was by putting benzol into it. But he thought Mr. Terrace had been somewhat too economical in its use. Mr. Jones asked if the quantity of benzol could not be increased so as to improve the illuminating power of the gas. Mr. Baker remarked that some four or five years ago they were in a similar state as at present; and then Colonel Sadler had kindly allowed them to draw upon his supply. He suggested that plenary power should be given to the Chairman to make similar or such other arrangements as might be desirable in the case of necessity arising. Alderman Bell said the Committee were spending between £3 and £5 a day in benzol. He would confer with the Mayor (Colonel Sadler) on the latter suggestion. The minutes were then adopted.

THE ILLUMINATING POWER OF THE GAS AT LEEDS.

The Justices' Reply to the Corporation Gas Committee.

Towards the end of last year, attention was directed in the "JOURNAL" to a letter which the Leeds City Justices had addressed to the Corporation Gas Committee on the low results of the tests of the illuminating power of the gas supply by the Justices' Examiner (Mr. C. Buckley), and to a subsequent discussion on the subject in the Council. On Dec. 18, the Gas Committee replied to the communication of the Justices, who forwarded a rejoinder on the 9th inst. The Gas Committee, in their letter, put forward the recent remodelling of some of the works as a cause why the illuminating power had fallen below the statutory standard. The Justices' answer to this was that there had been repeated complaints previous to recent times. The Committee further stated that some of Mr. Buckley's tests were not made at the legal place of testing, but at some distance therefrom. This applied to the gasholders at Sheepscar and Kirkstall Road. The Justices, however, asserted that they were confidently advised that both these places were "works" within the meaning of the statute; and they therefore dissented from the proposition that they were not legal places of testing. Then, in reply to a statement by the Committee that during its passage to these places the quality of the gas would somewhat deteriorate, the Justices argued that the loss of illuminating power was merely trifling for these short distances. But if, they pertinently asked, the loss was due to this cause, and had been so considerable in the case of the Sheepscar station, how was it that the Kirkstall Road station had consistently yielded better results, although at a much greater distance than Sheepscar from the place of manufacture? But whether the extent of depreciation be more or less, the Justices contended that by statute the gas ought to be sent out from Kirkstall Road and Sheepscar at not less than the legal standard; for, certainly, before it reached some of the consumers, it had to travel long distances, compared with which the distance to Sheepscar is inconsiderable. If the marked deficiency at Sheepscar was to be thus accounted for, what (the Justices with reason inquire) low degree of illuminating power may be expected by consumers at the extreme limits of supply? They ought at least to have the satisfaction of knowing that the gas, when started on its journey from the holders, was not below the standard. In their letter, the Committee also assured the Justices that they would take care their instructions to maintain an illuminating power of 18 candles were carried out; and this, subject to the foregoing remarks, gave satisfaction to the latter. The Justices concluded their letter by saying that, during the considerable number of years Mr. Buckley had held office, they had never found him to deviate from the strictest impartiality and fairness.

TYNEMOUTH GAS COMPANY'S BILL.

A Meeting of the Tynemouth Gas Company was held on Monday last week—Mr. J. B. WILLIAMSON presiding—for the purpose of approving of the Bill which has been deposited in Parliament by the Directors to empower the raising of additional capital.

The CHAIRMAN, in his opening remarks, referred to the increase in the population of the district, notably at Cullercoats, Whitley, and Monkseaton, which had made great demands on the productive power of the Company. In a report by their Engineer (Mr. W. Hardie, jun.), he declared his opinion that it was impossible to continue adding to their present works each year only so much as their increase demanded, but that it was desirable to duplicate their plant by erecting new works on ground adjoining the present ones. This was an opinion with which he (the Chairman) entirely agreed. The Directors asked the shareholders to authorize them to go to Parliament to apply for power to raise additional capital to the extent of £75,000, and to borrow on mortgage or debenture a further sum of £47,000—making a total of £122,000. In accordance with the present custom of Parliament, they would require to sell the stock by auction; any premiums so obtained going to form part of the £75,000, and not being in addition to it. They also asked that their present 10 per cent. stock and 7 per cent. share capital should be converted and consolidated into a uniform 5 per cent. stock, to bring it more into line with the rate of interest prevailing at the present time.

Mr. J. P. DODD, the Solicitor, having explained in detail the various clauses,

A resolution approving of the Bill was passed unanimously.

On the same day, the MAYOR (Mr. T. T. Bolton) presided over a public meeting of ratepayers and owners, convened for the purpose of consenting to the Town Council opposing the Bill.

The MAYOR explained that the object of the Corporation in opposing the Bill was to obtain the insertion of clauses which would benefit the ratepayers. The Corporation objected to the Company taking powers to supply gas beyond their present limits, as this would interfere with the efficiency of the supply to the borough. Then by the Company's Act of 1867, the maximum price for gas supplied to the borough was 4s. per 1000 cubic feet. The present charge was 2s. 3d.; and the Corporation were of opinion that the maximum price should be reduced. The charge for lighting the public lamps was 1s. per lamp per week. This, the Corporation thought, was excessive, and should be altered, or the meter system adopted, as was provided for in the Newcastle Gas Company's Act of last session. The Corporation also considered that the discounts allowed to consumers for prompt payment of their accounts should be increased, and the illuminating power of the gas be raised. The Corporation some years ago obtained a Provisional Order for the supply of electric light to the borough; and they wished to have power to discontinue the lighting of the public lamps by gas, and to seek for the introduction of a clause to that effect into the Bill. The mode of testing the pressure, as contained in the Act of 1867, was almost obsolete; and they sought powers to improve the method of ascertaining the illuminating power of the gas. With regard to the opening of the streets by the Company, the Corporation had for years experienced great difficulty in getting the public streets re-instated after trenches had been made in them. They were anxious that the re-instatement of the streets should be placed in their hands; and they asked for the introduction into the Bill of a clause to this effect. It was thought desirable that the upper surface of mains and service-pipes laid in the future should be 2½ feet from the surface of the ground. It was intended to submit these matters to the Company for their consideration; and it was hoped, as the Directors were reasonable men, they would be accepted. Should they, however, decline to adopt them, it would be necessary to oppose the Bill in Parliament; and, to enable the Corporation to do so, he submitted the requisite resolution.

Alderman ELLIOT seconded the motion, which was carried.

The Payment of "Standard Rate of Wages" by Contractors.—The Leicester municipal authorities have come to an important decision with respect to a protracted dispute at the works of Messrs. Guest and Chrimes, of Rotherham. A few weeks since, the Leicester Trades Council and one or two of the Labour members of the Town Council complained to the Gas Committee that the firm in question were violating the "fair wages" clause of the Corporation, and were accordingly no longer entitled to supply them with wet gas-meters. One of the representatives of the Brassworkers' Union subsequently interviewed the Gas Committee on the subject; and this was followed by a visit of Alderman Lennard, the Chairman of the Gas Committee, and Mr. Alfred Colson, the Corporation Gas Engineer, to Rotherham, in order to ascertain the employers' side of the complaint. These gentlemen submitted their report to the Gas Committee; and at their meeting yesterday week, it was decided to place no more orders with Messrs. Guest and Chrimes until they paid the full standard rate of wages to all the operatives they employed, and thereby complied with the Corporation's "fair wages" clause.

ROCHDALE CORPORATION GAS AND WATER DEPARTMENTS.

Progress and Improvements.

It is always interesting at the close of the year to turn to the retrospect published in the "Rochdale Observer," as, for a general newspaper, it invariably deals with peculiar intelligence with the affairs of the Gas and Water Departments of the Corporation. On the present occasion it says—

There are no events of special interest to chronicle in connection with the gas-works this year. The work in progress at the date of our last year's retrospect—viz., the new workshops, stores, and boiler-house, have been completed, and have added greatly to the convenience of working. Steady progress continues to mark the demand for gas; the consumption to date being in excess of that for the corresponding period of last year. There has, however, been no exceptional demand at any particular time within the past twelve months. The total production of gas up to Dec. 17 was 273,279,000 cubic feet, or about 3 million cubic feet in excess of the total for the corresponding period of last year, which was 14 million in excess of the return for the previous year. The largest quantity made in any one week has not so far exceeded last year's record of 15 millions; but the consumption on Thursday, Dec. 17, was the highest yet reached. It then exceeded 2,600,000 cubic feet, or nearly half a million more than the new gasholder could contain. The most discouraging feature in connection with this department is the constantly diminishing revenue from the residual products, owing to the fall in prices. Coke has been sold at 4s. 2d. per ton during the greater part of the year—a price it has only once previously touched within the past fifteen years, and then only for a comparatively short time; while sulphate of ammonia has reached the lowest price ever recorded. The Gas Committee have had under consideration the question of the adoption of a water-gas plant, which would diminish the quantity of coke to be disposed of; but no definite conclusion has, it is understood, yet been reached in relation to this matter. The Committee are also making inquiries with a view to deciding on the best method of reconstructing the old retort-house, the interior of which requires rebuilding and adapting to more modern methods of carbonization. The advisability of the Corporation putting down an electric lighting plant must likewise occupy the early attention of the Committee; and they will doubtless give it the careful attention they have always manifested in their management of the Gas Department.

Of late years the references in the retrospect to the water-works undertaking have invariably been cheering. Year after year the deficiency on the working of the department has been rapidly reduced. For the year 1885-6, it stood at £16,653; for the twelve months ended in March last, it was £5855; and there is every reason to believe that at the end of the present financial year, a further decrease will be reported. The cheapness of money, and consequent lessening of the annual cost of the debt, has had much to do with this improvement; but it is also due in large measure to the steady increase in revenue from sales. To this increase the borough and the extra-municipal districts served by the department have both contributed; and there is no reason to suppose that the expansion of trade is likely to cease. In spite of the large number of private supplies of water for business purposes, the sales to works, &c., have largely increased. Last year the revenue on this account was £5688, as against £3651 in 1885-6. The Water Committee believe they have heard the last of the lead-poisoning scare. The water is now treated with whiting, to prevent its action on the lead pipes; and, at a cost of about £50 a year, it is claimed that the danger has been removed. In the Littleborough and Wardle districts, where proportionately the largest number of poisoning cases occurred, medical men have testified that the water supply is now satisfactory. At Cowm and Spring Mill, the whiting is put into the filters; at Hamer Pasture, it is cast upon the water from a boat. It is found that the water will not dissolve more than half a grain of whiting per gallon, and that it has not been materially hardened by the treatment. There was a long period of drought during the summer. At the end of it, the stock of water in the reservoirs was equal to about 70 days' supply. If the drought had been as prolonged as in 1887, the town would have been perilously near a water famine. With continued growth in the demand for water, the Committee will be forced before long to consider how and where to increase the supply. The present reservoirs would not have sufficed till now but for the fact that the average consumption per head of the population is low in Rochdale. Whenever the advance has to be made, it is to be hoped that the Corporation will have better luck than when Spring Mill reservoir was made. With extensions at reasonable cost, there is no reason why the water-works should not become a profitable undertaking.

ELECTRIC LIGHTING NOTES.

At their meeting last Wednesday, the Hackney Vestry spent a considerable amount of time in discussing the electric light question. The report of the Special Committee on the subject of the appointment of Mr. F. H. Medhurst as Consulting Electrical Engineer, referred to in previous "Notes," was unanimously agreed to. It was also decided to rescind the resolution passed in January last year, authorizing the Electric Light Committee to engage Mr. Medhurst to prepare plans and specifications and also to invite tenders for the immediate carrying out of the combined electric lighting and refuse destructor scheme. In support of this motion, Mr. Hulland stated that "the Committee had, after mature consideration, come to the conclusion that, on both financial and scientific grounds, this particular scheme could not be carried out without considerable risk."

Last Saturday, a long memorial from the ratepayers of Newington was lodged with the Board of Trade. It set forth many reasons for the signatories' opposition to the Vestry's petition for a Provisional Order; the principal being as follows: (1) That the Vestry, by adopting the scheme, would certainly lose £3000 a year. (2) That the statements in the Vestry's memorial, as to the lines on which the various wards conducted their elections, are devoid of fact. (3) That the Vestry has so far entirely failed to see the advantage of having the electric light in its own Vestry Hall, notwithstanding that mains are laid close up to its doors. (4) That the statement that trade would improve if the electric light were provided for shops, is not borne out by facts. (5) That the loans of Newington have increased so tremendously within the last four years, that the parish is not in a position to risk an increase in its rates by adopting an electric lighting scheme. (6) That no single circumstance has arisen, or any single argument been placed before the Board, to induce it to alter its decision of last year. (7) That the eight compulsory roads now cost to light by gas £920 17s. 2d.; whereas electric light at only 2d. per unit, or half price, would cost £1538 6s. 8d. These are by no means the whole of the arguments adduced against the scheme.

The Walton-on-Thames District Council have refused their consent to the application of the Walton-on-Thames Electric Lighting and Power Company, Limited, for a Provisional Order. They have also passed a resolution to the effect that, in the event of the Order being granted, the Board of Trade should insist that the sum to be deposited as security for the execution of the works should be £1000.

Taunton is a town which has had upwards of ten years' experience of electric lighting; and from what appears in the local papers it has not been a particularly happy one. It seems that during the recent holidays the works ran the risk of a serious explosion owing to damage to the boiler flues and tubes; but this disaster was happily averted. At the meeting of the Town Council last Tuesday, it was decided to adopt the Brighton system of charging for current, with the view, it may be supposed, of stimulating business. The rates were fixed at 6d. per unit for the first two hours, and 2½d. per unit afterwards. This looks very much like desperation. After all the talk about electric lighting at 6d. per unit being "about" equal to gas at 4s. per 1000 cubic feet, it seems somewhat strange to have recourse to selling current at 2½d. per unit, which price, however considered, can leave practically no profit to the Electric Lighting Department upon working costs, and will help it very little, if anything, to pay the interest and the instalment of the sinking fund. Considering that the Corporation have had the light in their hands three years, and have lavished money and support upon it without much consideration for the ratepayers, and that the cost of public lighting has been increased £1000 a year (from £700 to £1700 roughly), it does not appear that the authorities find it to be anything better than a white elephant.

The repeated failures of the electric light at Portsmouth are felt most acutely by Alderman Ellis, the Chairman of the Corporation Electric Lighting Committee; and, according to a speech he made in the Council Chamber last Tuesday, he, to some extent, accepts the blame for the collapse that occurred on the 4th inst. This "accident," he said, was largely due to his want of judgment; for he never could foresee that there would be such a large demand for current, nor had his Committee anticipated it. The matter had been investigated by a Sub-Committee. They had come to the conclusion that the stokers, having found that steam was blowing off in the afternoon, shut down their dampers; and afterwards smothered the fires with fine coal, which was quite unfitted for the purpose. As a kind of sedative to the irritation which has been caused by the failures, Alderman Ellis added that, after deducting the sinking fund for the twelve months—£4545—from the gross profits of the undertaking, there would be left at the disposal of the Council on March 31 next the sum of £3690. He also predicted that in the near future the sum of £10,000 would have to be expended in extensions.

In a report submitted by the Finance Committee at the above mentioned meeting, there was a clause recommending a further prosecution of the Portsea Gas Company for supplying gas below the standard illuminating power on Nov. 28 and Dec. 1 and 2; but it was withdrawn. Was this withdrawal due to the satirical remarks which have been made concerning the prosecution of the Company and the failure of the electric supply a few hours later?

METROPOLIS WATER SUPPLY.

The Quality of the Water in the Past Year.

In the last monthly report on the Metropolitan Water Supply presented to the Official Water Examiner for the Metropolis (Major-General A. de Courcy Scott, R.E.) by Mr. W. Crookes and Professor Dewar, there is given the following table showing the bacterial variations in the water during the past year:—

Month.	Thames, Unfiltered.	Five Thames-derived Companies, Filtered.	New River, Unfiltered.	New River, Filtered.	River Lea, Unfiltered.	River Lea (East London), Filtered.
Jan.	1824	36	1525	31	2005	24
Feb.	1453	26	1368	29	1109	28
March	2160	41	1938	27	1900	29
April	1833	33	1501	17	1643	34
May	1301	21	950	25	1216	73
June	2081	32	836	35	1729	28
	1775	31	1353	27	1600	36*
July	2731	21	1885	22	2859	33
Aug.	1133	17	361	3	537	5
Sept.	1331	11	709	4	1642	14
Oct.	2691	19	671	4	742	14
Nov.	2223	21	1054	20	1178	6
Dec.	4613	60	2729	57	1825	15
	2453	24	1235	18	1464	14†
	2114	27	1294	22	1532	25‡

* Mean of first six months. † Mean of second six months. ‡ Mean of Year.

Messrs. Crookes and Dewar point out that the results here recorded show that, taking the whole year's bacteriological examinations, the high efficiency of the filtration and the excellent character of the London waters have been uniformly maintained.

SHEFFIELD CORPORATION WATER DEPARTMENT.

Salaries of Officials.

In connection with the re-organization of the staff of the Sheffield Corporation Water Department, the Water Committee submitted to the City Council last Wednesday proposals for promoting two of their chief officials, and augmenting their salaries. The first recommendation was that Mr. Leonard S. Marsh, at present Resident Engineer, should be appointed Engineer at a salary of £600 per annum; but this was met with an amendment that the advance should be from £450 to £500. It was pointed out that additional responsibility would be placed on Mr. Marsh under the re-organization scheme; but, notwithstanding, after a little conversation, the amendment was carried. Alderman Gainsford, the Chairman of the Committee, plainly told the Council that he refused to take the responsibility of this vote, and warned them of the seriousness of the position in which they had placed themselves. They had dispensed with the services of their late Engineer, and had declined to appoint a new one. The second recommendation was that Mr. Terrey be appointed General Manager, and that his salary be £800 per annum, instead of £600. To this an amendment was moved by Mr. Dearden that Mr. Terrey's present salary be continued. But, in this instance, the Committee were strongly supported; and the amendment was defeated by a large majority. Then a further amendment was proposed to the effect that the advance should be to £700 per annum; but this was also rejected by 32 votes to 14. The Committee's recommendation was then adopted.

THE NUNEATON DISTRICT COUNCIL AND THE EAST WARWICKSHIRE WATER-WORKS.

At last Wednesday's meeting of the Nuneaton District Council, Mr. R. W. Swinnerton moved a resolution in favour of purchasing the undertaking of the East Warwickshire Water Company—remarking that the members certainly considered the offer of the Executors of the late Captain Townshend a very noble one; and it had given the town an opportunity of possessing the water-works such as would never occur again (*see ante*, p. 36). The motion was carried without discussion. Mr. Swinnerton then gave notice that at the next meeting he would move that the undertaking should be purchased for the sum of £29,000.

On the same day, a well-attended meeting of property owners and ratepayers was held to consider the question. Alderman Haddon, who presided, gave those present full information on the subject. He enlarged upon the advantages accruing from the possession of a water supply by the town, and said a grand opportunity was now afforded them by the gift of £10,000 by the Executors of the late Captain Townshend. The concern was offered under conditions which stipulated that the price should be £29,000, which was not to include the plant now on order, or any new mains which might be laid, or the costs of the Bill now being promoted in Parliament. The Council were to take to the stores in stock, at cost price, less 20 per cent. discount; while certain temporary pumps and fittings were to remain the property of the Company, unless purchased by the Council, at a sum, with the stores, of not more than £500. The existing bondholders and shareholders in the Company were to accept, in place of their bonds and shares, redeemable bonds, to be issued by the Council, of £100 each, to bear interest at 2¾ per cent.; and the purchase was to be completed on or before Jan. 30 this year. The sum of £10,000, which had been deducted in arriving at the price named, Captain Townshend wished to be treated as a gift to the town. The Company was started ten years ago, and were now supplying a population of about 10,000 persons. The shareholders were not asking for any interest on their investment in the past. The Company were now promoting a Bill for an additional supply of water, owing to the rapid growth of the town during the last few years; and it was anticipated that the new works would yield an abundant supply for all future requirements. The Company were supplying about 200,000 gallons a day, about 50,000 gallons of which was for other than domestic purposes. The new source of supply had been tested for eighteen months, and more than 1½ million gallons a day had been pumped from it, without the yield diminishing. Assuming that only a third of this was permanent, it would supply upwards of 30,000 persons, at 15 gallons per head per day. Although the undertaking would not at once be a paying concern, there was no doubt it would be so in the near future; and the Council were unanimous as to the advisability of purchasing it. A resolution agreeing to the purchase of the works was carried amid applause.

Arbitration as to Water Rights at Ilkley.—An arbitration has been held at Ilkley in order to assess the amounts to be paid to the owners of land on Adlington Moor Side in respect of certain rights, easements, &c., required by the District Council in connection with the extension of the water-works. The Umpire was Mr. Thomas Winn, of Leeds; and the Arbitrators, Mr. J. Smith, of Bradford, for the claimants, and Mr. C. H. Hargreaves, of Ilkley, for the District Council. The Trustees of the Skipton Grammar School claimed £1347 in respect of their rights; and the Trustees of Mrs. Elizabeth Walls, £354. By their evidence, the District Council sought to show that the total loss of the Skipton Grammar School would only amount to £37 7s. 11d., including 25 per cent. for compulsory sale of the land; and that the estate would suffer no detriment by the action of the Council. Mr. W. J. Waugh, for the School Trustees, submitted that the water was valuable, and that Addingham might become customers for it, should their agreement with the Bradford Corporation terminate. Under the circumstances, he considered 2d. per 1000 gallons for the water the Council would take from the claimants' spring a very reasonable price. With respect to the claim of the Trustees of Mrs. Walls, the witnesses of the Council estimated the damage and loss which would be caused to the estate at the modest sum of £4 8s. 6d. Although the claims were not considerable, the proceedings extended over three days.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There is great commotion over the Edinburgh vacancy. The time for receiving applications expired last night; and I expected that to-day I would have been able to secure some information on the subject, but I have obtained nothing official. I have been told, by a gentleman who, it is true, is an outsider, that the whole matter has been arranged; and he gave me the name of the gentleman who has been selected for the post. It may be so, though I doubt it very much; and more especially so because the Committee who have the business in hand do not yet know who have applied. The position is this—that though yesterday was the last day for receiving applications, it was just possible that some might come in by post this morning. Therefore nothing could be done till to-day; and to-day being Saturday, the Committee resolved not to proceed in the matter till Monday. Meantime, none of the applications have been opened; that being left to be done in the presence of the Committee. This state of matters, however, is not inconsistent with the fact that not only the Committee but the Commissioners also are fully aware of from whom most, if not all, of the applications have come. Canvassing is going on very briskly among the Commissioners, who, in that way, have learnt who are applying. I myself have heard of a number who are among the applicants; but, except in the case of one, the information has not been communicated to me direct, and therefore I give no names. Suffice it to say that the area from which applications have come is very wide; and so is the range in the matter of qualification. And here let me say that the Committee who have framed the conditions of appointment, though they may be acting in the most perfect good faith in every respect, have put a number of people to great inconvenience, and very probably great annoyance ultimately. They have not made up their mind as to the salary they are to give; and the result is that gentlemen have applied who, I am certain, would not have done so unless on the supposition that a most handsome salary would be paid. I have heard of two gentlemen, neither of whom, I am convinced, would accept of less than a sum in four figures; and more especially as, it is said, the gentleman appointed is to be required to relinquish all outside employment. This is another condition which, if it had been made known, would have prevented some from the disappointment of applying and being rejected. I have very authentic information regarding one of the applicants—a most estimable manager, and altogether a most suitable man—whose application it may be too much to say has been rejected, because technically none have been so yet; but it is freely said that it will fail because of a commercial connection he has. Then, again, the Committee have fixed an age limit. They are informing canvassers that they will not appoint anyone who is over 40 years of age. These are three matters which, if they intend to insist upon them, they might have made known. I quite recognize that the Committee are not the Commissioners, and the latter may disregard any of these stipulations; but if the Committee wished to impose any conditions, they should have first obtained the consent of the Commissioners, and have stated the conditions in their advertisement. If the Commissioners adhere to the conditions of the Committee, they will exhibit, if nothing more, at least a great want of respect for the feelings of an honourable body of men, in first displaying a very wide door and then planting down a very strait wicket. I wonder if these restrictions had been made known to some privately. Though the applications are very numerous, there are some of the most noted engineers and managers in Scotland who have not applied. It is said of one of these that, if he had chosen to apply, he would almost certainly have obtained the appointment; but he has not applied. Of another it was also said that, barring the first one, he might have had it; but he, too, did not apply. Besides these two, there are others who might have been expected to be tempted by the offer of the Commissioners, and some of whom would have filled the post quite satisfactorily. They seem, however, to have got an inkling of what was likely to be, or they may have been too comfortable to be induced to move. At all events, they are not on the list. The regular meeting day of the Commissioners is the 25th inst.; but they may hold a special meeting earlier, if they are agreed, to make the appointment. On the other hand, if they act with deliberation, as they ought to do, they may not even then be ready to appoint.

The Stirling gas-works transfer has arrived at the critical point. The post-card vote has been taken; and it is decidedly against the acquisition of the gas undertaking. The vote was taken by what are known as the Joint Ward Committees. They sent out 3219 reply post-cards, with the question: "Are you in favour of the Stirling Police Commission purchasing the gas-works for £61,130, which does not include cost of stock, alterations, renewals, &c.?" Replies were received from 2238 persons, of whom 2099 said "No," and 139 "Yes." Adding the 981 who did not reply to those who were favourable, the figures come out: For, 1120; against, 2099—majority against, 979. The Committees met on Wednesday night, and jubilated over the result, to the extent of passing votes of thanks to two newspapers which had "championed the popular rights." Save the mark! "Championed the silly-willies" would have been more appropriate. In the first place, the Police Commissioners have already made to the Gas Company the offer of the £61,130 recommended by Mr. M'Gilchrist; and if the Company accept the terms, the transaction will be completed, in spite of this vote. But, in the next place, the question was either stupidly put, or it was framed so as to alarm the ignorant. Mr. M'Gilchrist, in his report, did not state that the Commissioners were to pay the cost of "alterations, renewals, &c.," over and above the £61,130. He said the sum did not include accounts due by consumers (to the date of transfer, of course), cash balances, sinking fund, or the stocks of gas, coal, and other unused materials in the works. The reason for the exceptions was obvious. The funds excepted had been earned by the Company; and the stocks on hand had been purchased by them, and were their own property. If the Commissioners paid for the stocks on hand, they would sell them at a profit; and the cost of them would not be price. If they did not purchase the unused fittings from the Company, they would have to buy from someone else; and the cost of these, again, would not be the price. But either

the Joint Ward Committees did not know that, or, knowing it, they did not put it into their question. I incline to the view that they did not know. It was a case of the "blind leading the blind."

The Police Commissioners met on Monday, and had before them a report by their Gas-Works Committee, which stated that they had an interview with the Directors of the Company on the 9th inst. The Chairman of the Directors then asked if, in view of the fact that Mr. A. Gillespie had reported the valuation of the Company's undertaking to be £68,390, the Committee had any suggestions to make, to which the Committee replied that they had no instructions from the Commissioners to deal with the Company except on the terms contained in Mr. M'Gilchrist's report; that a suggestion was made by the Directors that the price might be paid in terminable annuities, but that the Committee expressed the opinion that the Commissioners would prefer to pay a sum down instead of annuities; and that the Directors promised to consider the whole matter, and let them have a reply soon. The shareholders, I understand, are to be convened and the subject laid before them without any recommendation by the Directors. The question for the shareholders is thus whether they will sell at £61,130, for it may be taken for granted that the Police Commissioners will offer no more. The consideration with them will be that, if they do not accept the offer, they will have to obtain parliamentary sanction to their undertaking, and need look for no attempt at a transfer for years to come. The consideration with the Commissioners should be that, unless they come to terms now, the Company, after they obtain parliamentary powers and expend money on their undertaking, will not be disposed to sell it except at a sum much greater than is now offered. The question of transfer or no transfer will be decided very soon.

Some person with a meddling disposition, has been trying to introduce an element of discord between the Dunfermline Gas Company and the Town Council. As I said last week, the Town Council have done nothing as yet to implement the award of the Arbiters; but this has since been explained by Provost Walker to be on account of the fact that the Council have not paid the price, and that until they do so the works are being managed by the Directors as trustees for the Corporation. The Town Council have taken no interest in the gas-works as yet. The award in the arbitration was recorded in the books of Council and Session in Edinburgh—a necessary formality to give it legal effect—on Dec. 26; and the price could have been claimed by the Company at any time after that. The Company have not done so; but the Corporation expect to be able to pay soon. They put off negotiating for money on account of the rise there was in the bank rate, in the expectation that they would get better terms now; but in this they seem to be disappointed. They can no longer wait, but must procure the money at once. As soon as the price is paid, the undertaking becomes the property of the Corporation. I hear that the stocks and other matters having been valued, the total sum which the shareholders of the Company are to receive is £104,000, which makes the outcome of the arbitration look better than the award did. But to the point with which I began this paragraph. In the course of the negotiations with reference to a settlement, claim was made on behalf of the Corporation to the £5000 with which the Company paid their dividend for the year ending May 31, 1896. In the award, the Corporation were found entitled to "all accounts due to the Company, and all money belonging to the Company, in bank or on hand." Now, as a matter of fact, the £5000 was money in bank or on hand; and upon a very strict reading of the award, it passed to the Corporation, because it was not distributed till after the annual meeting of the shareholders, which is held in July. The Corporation Committee took advice on the subject, first from one of their own officials, who gave it as his opinion that the £5000 belonged to the burgh. The Solicitor for the Company, on the other hand, maintained that the money was the property of the Company; and litigation to determine the point at once rose in prospect. Before embarking upon it, however, the Corporation laid the subject before the Counsel who represented them in the arbitration; and they unhesitatingly gave their opinion that the dividend money of last year was not included in the award. The matter is therefore at an end. It probably arose out of the wording of the award. If it had been decided that the Corporation were entitled to the money, it would practically have been setting back the transfer to May 31, 1895, because after that date the shareholders would have had no interest whatsoever in the working of the undertaking. This would have been an absurd position of affairs with a vengeance.

The output of gas from the Perth Corporation Gas-Works during the past month showed an increase of 2,131,900 cubic feet over the same month of last year; and for the period of the year which has elapsed, the increase amounts to 7,961,800 cubic feet. There has been an increase of 11·61 per cent. on the quantity made, and of 11·73 per cent. on the gas delivered. Mr. D. D. Dewar, the Collector for the Commissioners, who has been in the service of the gas supplying body in Perth for 48 years, has resigned his post, and has been allowed a retiring allowance of 20s. per week. Mr. Ferguson Stewart, who is already in the service of the Commissioners was appointed Collector.

The Motherwell Commissioners some time ago approached the Gas Company, asking that a reduction should be made in the price of gas to the burgh in proportion to the reduction given to the general consumers. At the monthly meeting of the Commissioners on Tuesday night, a letter from the Secretary to the Gas Company was read, intimating that the application had been placed before the Directors, who state that they cannot see their way to make any alteration in the prices fixed for this year, as in fixing the rate for the year they were most anxious to make it at the lowest possible figure to the general public, with the result that they now find that no gas company in Scotland is selling gas at a less price than the Motherwell Gas Company, and only four town councils are cheaper. They are hopeful, however, that when their new plant is fully employed, they will be able to intimate a further reduction.

At a meeting of the Police Commissioners of Helensburgh on Monday night, Mr. Mackay, one of the Commissioners, gave notice of motion to the effect that a Committee be appointed to communicate with the Directors of the Gas Company, and obtain information as to the terms on which they would be willing to sell their undertaking to the Corpo-

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 119).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	107—110	+2	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	10—10½	..	4 15 3
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	102—105	..	4 15 3
200,000	5	12 Nov.	6½	Bombay, Limited	7½—8	..	4 1 3
40,000	5	,,	6½	Do. New, £4 paid	5½—6	..	4 6 8
380,000	Stck.	13 Aug.	12	Brentford Consolidated	290—295	+2	4 1 4
210,000	,,	,,	9	Do. New	225—230	+10	3 18 3
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130—134	..	2 19 9
220,000	Stck.	16 Sept.	11½	Brighton & Hove Original	270—275	..	4 3 7
208,820	,,	,,	8½	Do. A Ord. Stk.	185—190	..	4 9 5
933,500	Stck.	28 Aug.	5	Bristol, 5 p.c. max.	127—132	..	3 15 9
420,000	20	15 Oct.	11½	British	56—57	..	3 18 11
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	22—23	..	5 0 0
71,000	10	,,	8½	Do. 7 p. c.	19—20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	10½—10¾	..	5 11 8
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101—103	..	5 16 6
150,000	20	15 July	8½	Cagliari, Limited	29—31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16—17	—½	3 10 7
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	15 Oct.	13½	Commercial Old Stock	338—343	..	3 18 8
165,000	,,	,,	10½	Do. New do.	255—260	..	4 0 9
165,000	,,	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150—155	..	2 18 0
800,000	Stck.	30 Dec.	13	Continental Union, Limited.	260—265	..	4 18 1
200,000	,,	,,	10	Do. 7 p. c. Pref.	215—220	..	4 10 11
51,620	Stck.	28 Aug.	14	Croydon Com'cial A 10 p. c.	315—320	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.	250—255	..	4 6 3
535,000	Stck.	28 Aug.	5½	Crystal Palace Ord. 5 p.c. Stk	140—143	..	3 13 5
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
436,090	10	15 July	11	European, Limited	25⅜—26½	..	4 3 0
334,950	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 11
5,746,590	Stck.	13 Aug	12¾	Gaslight & Coke, A, Ordinary	315—320	..	3 19 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	110—115	..	3 9 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	305—315	..	3 3 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	147—152	..	3 5 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	212—217	..	3 9 1
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	305—315	..	3 3 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	175—180	+3	3 6 8
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137—142	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155	..	2 18 0
908,000	,,	,,	6	Do. 6 p. c. do.	203—208	..	2 17 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12—13	..	4 12 4

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	12 Nov.	12	Imperial Continental	2:8—235	+10	5 6 8
376,400	100	1 Aug.	4	Do. 4 p. c. Debs. Red.	101—103	..	3 17 8
473,600	Stck.	13 Aug.	3½	Do. 3½ p. c. Deb. Stk	105—108	..	3 4 10
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	6—6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	111—115	..	4 6 11
250,000	100	,,	4½	Do. 4½ p. c. Debs.	109—111	+1	4 1 1
541,920	20	12 Nov.	5	Monte Video, Limited	16—17	..	5 17 8
150,000	5	26 Nov.	8	Oriental, Limited	8½—9	..	4 8 11
135,000	5	,,	8	Do. New, £4 10s. paid	7⅞—8	..	4 10 0
15,000	5	,,	8	Do. do. 1879, £1 paid	1⅞—2	..	4 0 0
60,000	5	16 Sept.	7	Ottoman, Limited	5—5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	100—106	—1	5 13 2
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	100—105	..	5 14 3
250,000	10	30 Sept.	10	San Paulo, Limited	13—14	..	7 2 10
5,475,000	Stck.	13 Aug.	5⅞	South Metrop., 4 p.c. Ord.	145—149	..	3 9 9
820,000	,,	15 July	5	Do. 5 p. c. Deb. Stk.	163—172*	+½	2 18 2
60,000	Stck.	16 Sept.	11½	Tottenham & Edmonton, A	280—290	+10	3 19 4
60,000	,,	,,	8½	Do. B	190—200	+10	4 5 0
170,380	10	30 Dec.	10	Tuscan, Limited.	14—15	..	6 13 4
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	100—102	..	4 18 0
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	333—338	..	3 2 2
150,000	,,	,,	5	Do. 5 p. c. Pref.	175—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	158—162	..	2 15 6
175,785	,,	30 Sept.	4½	Do. 4½ p. c. Deb. Stock	162—167	..	2 13 11
1,719,514	Stck.	15 Oct.	7	East London, Ordinary	228—233	..	3 0 2
554,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	162—167	..	2 13 11
225,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	105—107	..	2 16 1
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	115—120	..	3 2 6
295,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150—155	..	2 11 7
708,000	Stck.	13 Aug.	12	Kent	340—345	..	3 9 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	215—220	..	3 3 7
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	270—275	—1	3 9 1
406,200	100	,,	7½	Do. 7½ p. c. max.	222—227	..	3 6 1
350,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150—153	..	2 12 3
500,000	100	13 Aug.	12⅝	New River, New Shares	420—425	..	3 0 8
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk.	153—156	+1	2 11 3
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	153—158	+1	3 15 11
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	149—154	+2	3 17 11
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175—180	+1	2 15 7
1,019,585	,,	30 Sept.	4	Do. 4 p. c. A Deb. Stk.	148—151	..	2 13 0
1,155,066	Stck.	11 Dec.	10	West Middlesex	310—315	..	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163—168	..	2 13 7

*Ex div.

ration; and also to inquire into other matters relative to the more satisfactory and more economical lighting of the burgh.

The last report dealing with the stove-hiring department of the Glasgow Gas Trust showed that there were then on hire 12,979 gas-stoves and kitchen-range fittings, &c.; and the sales of stoves, range-fittings, gas-fires, heaters, burners, &c., through this department at the same time, amounted to 20,151.

The lecture which Mr. D. Macfie delivered to the plumbers in Edinburgh on Thursday night (a report of which appears in another column), is a valuable contribution to the problems of lighting. Delivered to a body of practical men, it should do much more good than if it had been given to men connected with gas supply. Mr. Macfie put his subject in admirable form. He had appliances with which to illustrate his points; and their use sent home the lessons he wished to teach. The plumbers were an attentive audience; and so they might be, for they learned things which had never been inculcated in their hearing before. The two points of the lecture which took my attention most were the invention which Mr. Macfie exhibited, of a hanging chimney for incandescent gas-burners, and his tribute to the merits of the "Holophane" globe. The chimney is, of course, hung upon a plate which rests on the top of the globe. It seems to be a useful invention, though time would be required to test it. With regard to the Holophane globe, I am glad that he bears out what I wrote on the subject some time ago. The wonder is that so small a number are being run. Few in the meeting had ever seen one before; and a gentleman at the close of the lecture said he did not know where they were to be obtained. Mr. Macfie should be able to put that right. I may say that I prefer the old form of globe to the new; and I consider the rose colour-tinted glass which has been introduced is not an improvement. But that is opinion; the merit of the globe in the matter of improving the light is undeniable.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 16.

Sulphate of Ammonia.—The week opened with a very firm market; and sales were made at some further advance. But within the past few days, it has become weaker; and the top prices reached are not now obtainable. Quotations are £8 to £8 1s. 3d. per ton f.o.b. at the ports. Consumers have only partly followed the market; most of the buying during the past three weeks having been done by dealers, who, for the present, appear to have covered their immediate requirements. In the forward position, business has been done at £8 5s. per ton over spring months; and higher prices are now asked, but buyers do not seem keen of paying the premium. They appear to be more disposed to buy a month or two ahead, if at about spot prices, which, however, is not found practicable.

Nitrate of Soda is firmer in all positions. Consumers, home and Continental, have largely kept their hands free. But, the weather since before Christmas having been open, they have now come forward; and holders (whose patience during the past months must have been severely taxed) seem inclined to make the most of it. Hence an advance of 3d. per cwt. is required, all round; and buyers who cannot wait will have to pay it.

LONDON, *Jan.* 16.

Tar Products.—The better tone in the benzol market continues. Buyers are pressing for deliveries on contracts; and the article is undoubtedly scarce. A good deal of inquiry exists for solvent naphtha, and also for heavier naphthas, which are now selling at better prices than formerly. Pyridine has touched a record price; the production evidently being short of requirements. Carbolic acid is a little firmer for export. Home buyers, in some instances, however, are offering slightly lower prices. Authracene is dull; and producers outside the Tar Sales Committee are offering at lower prices. Some considerable lots have changed hands, under special circumstances, at a price somewhat above the quotation given below. A little improvement has come to creosote and tar oils. Pitch, however, is still languid; but large shipments are being made against old contracts.

Values may be taken as follows: Tar, 18s. to 25s. Pitch, 26s. 6d. Benzols, 90's, 3s. 4½d.; 50's, 3s. Solvent naphtha, 1s. 7½d. Crude, 30 per cent., naphtha, 1s. 2½d. Creosote, 1⅜d.; liquid, 2⅜d. Heavy oils, 4os. Naphtha, 65s.; salts, 32s. 6d. Carbolic acid, 60's, 2s. 2d. Anthracene, "A," 8½d. to 10½d.; "B," 7½d. to 8d.

Sulphate of Ammonia shows a firm market. A large business is being done, and stocks are rapidly decreasing. There are buyers at £8 to £8 5s. less 3½ per cent., according to position and conditions, at all ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no appreciable change to report in the position of the coal trade here. Business continues fairly brisk; and pits generally are working full time, with prices firm at recent quotations. Coal for steam and general manufacturing requirements, meets with a ready sale; any surplus of supplies being confined to some of the inferior sorts of engine fuel. A firm tone is maintained as regards prices, with, if anything, rather a hardening tendency; but any actual advances are chiefly restricted to forward contracts. At the pit mouth, best Wigan Arley still averages about 10s. 6d. to 11s. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; steam and forge coal, 6s. 6d.; and engine fuel, 3s. to 3s. 6d. for common slack, and 4s. 6d. to 5s. for best qualities. In the shipping trade, business continues active, and rather better prices are being obtained. Good ordinary qualities of steam coal average from 8s. to 8s. 6d. per ton delivered at the Garston Docks or High Level, Liverpool; and from about 8s. 6d. to 8s. 9d. delivered at the Partington tips on the Manchester Ship Canal.

Northern Coal Trade.—There has been increased activity in the coal trade in the past week. Best Northumbrian steam coal is now

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Essential in all Sick Rooms—Especially Bronchial Cases.

Gas-Fires are often objected to on account of the disagreeable Products of Combustion escaping into the Room immediately after lighting.

The absence of an Up-Draught in the Flue or Chimney causes this.

The Patent Improvements consist in affixing a Bunsen Burner at the **Flue opening**, for the purpose of **producing an Up-Draught. A removable Cap** is arranged in the Canopy. After lighting the Bunsen Burner, the Gas-Fire may be lit in two minutes.

APPLIED TO ALL SIZES OF

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"GORDONS,"
"MAGNETICS,"
"BRITANNICS,"

AT 10s. EACH EXTRA.

quoted at 8s. per ton f.o.b.; and second qualities vary from 7s. 3d. to 7s. 6d. With the fuller working of the steam coal collieries, there is a larger output of small coals; and the price is weaker, at 3s. 3d. per ton. In the Durham coal trade, there is great activity; the demand for gas, household, and coking coals being very heavy, and the prices firm. Gas coals are still in great request; and the shipments are above the average. Few new contracts have been booked this year; but for occasional supplies of best Durham gas coals, 7s. 6d. per ton f.o.b. is asked. The manufacturing coal trade is unaltered in price; but there is now a normal consumption. There is no alteration in the price of gas coke this week; but the consumption is large enough to cause stocks to be a little higher. The question of the wages of the Durham miners comes now to be soon discussed; and it is probable that there will be shortly some slight concession made, as some of the contracts for coal show an improvement in price.

Scotch Coal Trade.—The coal trade is in a very satisfactory condition; there being plenty of work, with prices firm. The men are continuing their agitation for a further advance in wages, which, however, is not likely to be granted in the meantime. The prices quoted are: Main, 6s. 9d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; splint, 7s. 6d. The shipments for the week amounted to 97,520 tons—a decrease upon the preceding week of 25,313 tons, but an increase upon the corresponding week of last year of 4567 tons.

Improved Sulphate Plant for the Stratford-on-Avon Gas-Works.—The Stratford-on-Avon Town Council have agreed to a recommendation of the Gas Committee that new sulphate of ammonia plant be provided at the gas-works, at a cost of £300. It is expected that the new plant will effect a saving of about £30 a year in fuel and wages, and produce an increased amount of sulphate.

Dinner to the Staff and Workmen of the Kent Water Company.—On Friday, the 8th inst., Mr. W. Morris, the Engineer of the Kent Water Company, entertained the staff and workmen of the Engineer's department at dinner at the Cannon Street Hotel. The toast of "The Queen" having been honoured, Mr. Morris asked those present to drink success to the Kent Water Company, calling for three cheers for the Directors, and then three more for the Company's able and energetic Secretary, Mr. Alexander Dickson. In proposing the toast of "The Company's Staff and Workmen," Mr. Morris coupled it with the name of Mr. Richard Luke, who had been in the Company's service more than fifty years, and who would reach the eightieth anniversary of his birthday on the following Sunday. Mr. Luke proposed the health of Mr. Morris, which was received by the company with enthusiasm. Before separating, Mr. Luke, in the name of the workmen and staff, presented Mr. Gerald Morris (son of the Engineer), who has just attained his majority, with a handsomely fitted dressing-case; and his health was drunk with musical honours. A capital selection of songs enlivened the proceedings.

An Installation of Acetylene Gas is now in operation at the house of Mr. J. Holgate, a cotton manufacturer, at West Bradford. The gas is made upon the premises.

Folkestone Gas Company.—The gross revenue of the Folkestone Gas Company last year was £36,400, of which £9476 was profit; thus enabling the recommendation of a dividend of 10 per cent. on £45,000 of the capital and 7 per cent. on £65,000 of the capital.

Sales of Shares.—Sixty new 7 per cent. £10 ordinary shares in the Ormskirk Gas Company were sold by auction last Tuesday at £17 and £17 10s. per share. The ordinary shares of the Company have regularly paid a dividend of 10 per cent. for the past forty years. The preceding day, sixty £10 shares in the Airdrie Gas Company were sold by auction at prices ranging from £19 15s. to £19 17s. 6d. apiece.

An Inquiring and Candid Councillor.—Mr. J. Hooper is a member of the Seaford District Council; and no doubt his public utterances have great weight in the town. He considered it his duty, at a recent meeting of the Council, to make some strong remarks concerning the illuminating power of the gas, without first ascertaining whether the cause of the poor light he obtained was not to be found at home. After decrying the gas in public, Mr. Hooper did what he should have done before. He paid one or two surprise visits to the gas-works; and, being an honest man, he reported the result of his investigation at the last meeting of the Council. He said he found that the consumers were supplied with gas of full illuminating power; and therefore the fault must lay with the fittings of those gentlemen who had complained of the poor lighting power of the gas. He had also complained very much about the light in his house; but he had certainly obtained an improvement with better burners, notwithstanding that he had been strongly against them at the previous meeting. On Dec. 21 the illuminating power of the gas was 16 candles, and that day it was 15¾ candles; so that he made a somewhat rash statement when he said the gas was of low illuminating power. He said this in justice to the Gas Company.

Tenders were opened last Friday for £120,000 of the New River Company's 3 per cent. "C" debenture stock, amounting to £598,400, at prices ranging from £110 per cent. to par. Tenders at £105 6s. will receive about 50 per cent. of the amounts applied for, and all above that price in full.

The Lighting Corporation, Limited, of No. 4, Bloomsbury Street, W.C., have just issued a neatly-printed revised catalogue and price list of their improved Wenham patent gas-lamps and fittings, gas governors (Carter and Lee's patent), louvre ventilators, &c. Included therein are general instructions for properly fixing and using the lamps; and by views of one of the show-rooms and of a portion of Piccadilly their applicability to both interior and public lighting is illustrated. The catalogue should be in the hands of all gas managers who desire information as to the scope of the Corporation's business, or as to the various installations of their systems of lighting and ventilating.

NEW "PENNY-IN-THE-SLOT" COOKERS.

Arranged specially for Prepayment Meters.

We have given particular attention to the strength and simplicity of these Cookers, which are constructed upon the principle of our celebrated "Eureka" Cooker, and are practically indestructible. They are very easily cleaned, and are all constructed in as many parts as possible, so that, in case of breakage, the parts may be readily and cheaply replaced.

No. 403 and 404.

No.	External Dimensions.			Oven.			Hot Plate.	No. of Boiling-Burners	Price.	White Enamelled Crown extra.
	High.	Wide.	Deep.	High.	Wide.	Deep.				
401	18½	13½	11½	14	11	9½	13½ by 11½	1	28/6	—
402	24½	15½	15	18	11	11	15½ ,, 15	2	40/-	2/6
403	30	18	17	19	11	11	18 ,, 17	2	45/-	2/6
404	30	18	17	19	13½	11	18 ,, 17	2	50/-	2/6
404	If fitted with Enamelled-Lined and Jacketted Door and Fire-Brick Crown, as adopted by The London Gaslight and Coke Co.								55/-	2/6

Any of these Cookers, except No. 401, can be fitted with Griller at an extra charge of 2/6; but the adoption of the Griller is not recommended for use with Prepayment Meters.

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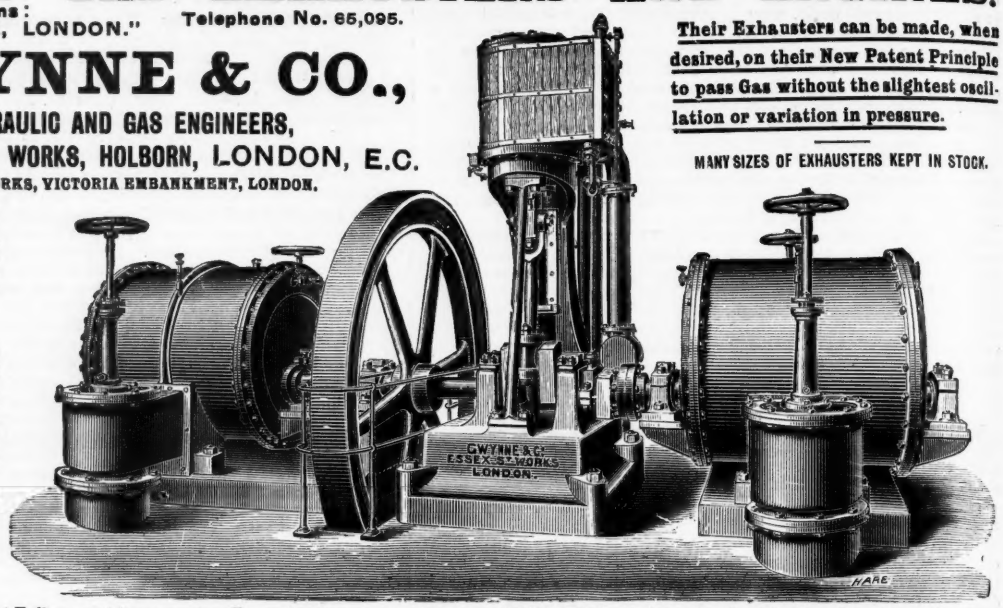

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[For Illustrated Advertisement see Jan. 5, p. 48.]

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Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

WANTED, by a Young Man, a Situation as INSPECTOR. Able to fix Meters and Stoves, and do general Fitting. South of England preferred.
Apply to the MANAGER, Gas-Works, ROMSEY.

YOUNG Man desires Situation in Gas or Water Office as CLERK or COLLECTOR. Ten Years' general Experience in a large Midland Gas Accountant's Office. Age 25. Good References.
Apply, by letter, to No. 2778, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a re-engagement as Working MANAGER in Small Works. Good Carbonizer, can lay Mains and Services, fix Meters, read Indices, or do Internal Fitting. Eight Years in last Situation. Good References.
Address FRANE, care of Manager, Gas-Works, Whitchurch, HANTS.

WANTED, a Situation as Working FOREMAN. Well up in Gas Stoves, Fires, Meters, &c., and all kinds of Pipe Work. Age 38 years. Abstainer. Good References.
Address No. 2783, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GENTLEMAN, with knowledge of DRAWING and Experience in TRAVELLING and general routine of Gas Engineer's Office, is open to Engagement. Has good connection with Gas Companies, and no objection to go abroad.
Address No. 2786, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Manager of small Gas-Works or FOREMAN of large Works. First-class Testimonials as a Carbonizer and a thoroughly practical Man in all Fittings and Mechanical Branches.
Address No. 2784, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Stoker for Small Works. Used to Shovel Charging and Exhauster. Abstainer preferred. Wages, 25s. per week.
Apply to the MANAGER, Gas-Works, ROMSEY.

WANTED, a Main and Service Pipe LAYER, who can fix Meters and take Indices. A permanent Situation for a suitable Man.
Apply, by letter (enclosing *copies* of Testimonials, and stating Wages required), to the MANAGER, Gas-Works, REDDITCH.

SERVICE LAYER WANTED.

WANTED, immediately, a steady re- liable FITTER as Outdoor Service Layer for a Gas Company in South Wales.
Apply, by letter, with Character, to No. 2787, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHATE MAKER WANTED.

WANTED, an active Workman accus- tomed to work an ordinary SULPHATE of AMMONIA PLANT (with open Evaporator), and attend to Pumps.
Apply to the undersigned.
M. RICHLEY,
Secretary.
Gas Company's Office,
Shotley Bridge.

GIBRALTAR GAS COMPANY.

WANTED, a Man competent to Repair and TEST GAS-METERS, and experienced in Gas-Fitting and Fixing of Stoves and Meters. Age not to exceed 35 years. Abstainer preferred.
Wages $15 per week (equal to £2 10s. Sterling) of fifty hours. Passage Out and Home, and Contract for Three Years.
Address, stating Age and Qualifications, with References, the GIBRALTAR GAS COMPANY, GIBRALTAR.

WANTED, an Energetic Man of Business to SOLICIT ORDERS in Sheffield and its Locality for the INCANDESCENT GAS-BURNER.
Apply, by letter, to the undersigned, stating Experience, where previously employed, Salary required, Age, &c. Only capable Men need apply.
HANBURY THOMAS,
General Manager and Secretary.
Sheffield United Gaslight Company,
Commercial Street, Sheffield,
Jan. 13, 1897.

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Second-hand SCRUBBER-WASHER, to pass 500,000 cubic feet per day. State Size, Age, and Makers. Must be cheap.
Address No. 2785, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

OFFERS wanted for fifty "A" £5 Shares in the Hoylake and West Kirby Gas and Water Company. Dividends thereon for 1896, £26 10s.
Address S 34, care of C. Birchall, 7, Victoria Street, LIVERPOOL.

FOR SALE, cheap—
One Two-Lift GASHOLDER and CAST-IRON TANK, 64 ft. by 16 ft.; Capacity, 98,000 cubic feet.
One CAST-IRON TANK, 65 ft. by 16 ft.; Capacity, 331,800 gallons.
One TWO-LIFT GASHOLDER, 50 ft. by 16 ft.; Capacity, 63,000 cubic feet.
One CAST-IRON SCRUBBER, 38 ft. 6 in. by 6 ft. diameter.
EXHAUSTERS, 5000 to 60,000 cubic feet per hour.
We would undertake to re-erect any of the above, if desired.
Photos, Particulars, and Prices of above on application to SAML. WHILE AND SONS, 60, Queen Victoria Street, LONDON, E.C.

COAL-WAGGONS FOR HIRE.

FIFTY 10-ton Waggons to be Let on HIRE, or may be SOLD.
Address "OWNER," care of Wm. Dawson and Sons, 161, Cannon Street, CITY, E.C.

FOR SALE—Four 8 feet square Purifiers, with 8-inch Connections and Centre-Valve, Lifting Gear, &c., complete. Also Four Sets of RETORT MOUNTINGS for 15-inch Round Retorts in Settings of Six. No reasonable offer refused.
Apply to H. WIMHURST, Gas-Works, SLEAFORD.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

URBAN DISTRICT COUNCIL OF PADIHAM.
(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the supply of RETORTS, FIRE-BRICKS, &c.
For Particulars, apply to the undersigned.
Tenders, endorsed "Tender for Retorts, &c.," and addressed to the Chairman, Gas Committee, District Council Office, Padiham, must be sent in not later than Saturday, Jan. 30, 1897.
By order,
J. R. SMITH,
Clerk.
District Council Office,
Padiham, Jan. 16, 1897.

AMENDED ADVERTISEMENT—EXTENSION OF TIME.
BOROUGH OF WORKINGTON.
(GAS DEPARTMENT.)

TENDERS FOR GASHOLDER, &c.

THE Corporation of Workington invite TENDERS for STEEL GASHOLDER, BRICK TANK, &c.
Plans and Specifications may be seen at the Engineer and Manager's Office, Stanley Street, Workington.
Tenders to be delivered to the undersigned not later than Twelve o'clock noon on Tuesday, the 26th inst., endorsed "Tender for Gasholder, &c."
The lowest or any tender not necessarily accepted.
JOHN WARWICK,
Town Clerk.
Town Hall, Workington,
Jan. 6, 1897.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.
IMPORTANT ISSUE OF £10,000 STOCK OF THE BRIGHTON AND HOVE GENERAL GAS COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Wednesday, the 10th of February, at Two o'clock precisely, in lots of £100 each,
£10,000 OF "A" ORDINARY STOCK
OF THE
BRIGHTON AND HOVE GENERAL GAS COMPANY,
ranking for a Standard Dividend of 7 per cent., subject to the Sliding Scale; the last Dividend on the Company's "A" Stock having been 8½ per cent. per annum.
Particulars of the SECRETARY of the Company, at No. 5, GREAT WINCHESTER STREET, E.C., and 77, West Street, BRIGHTON; of Messrs. HOWLETT AND CLARK, of 8, Ship Street, BRIGHTON, Solicitors to the Company; of Mr. RALPH HOMAN, Stock and Share Broker, 2, Austin Friars, LONDON, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Executors of the late William Bellingham, Esq., and other Executors and Owners.
IMPORTANT SALE OF GAS AND WATER STOCKS AND SHARES OF THE CAPITAL VALUE OF UPWARDS OF £20,000.

MR. ALFRED RICHARDS will Sell by AUCTION at the Mart, London, E.C., on Tuesday, Jan. 26, at Two o'clock, GAS AND WATER STOCKS AND SHARES in the following Companies:—
LEA BRIDGE DISTRICT GAS COMPANY,
60 £10 Shares.
BRENTFORD GAS COMPANY,
£400 Ordinary Stock and £3780 New, 1881, Stock.
GREAT YARMOUTH GAS COMPANY,
61 £30 Shares.
BARNET DISTRICT GAS AND WATER COMPANY
£1120 "A" Stock.
TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY,
£500 "A" Stock.
HORNSEY GAS COMPANY,
£1360 "B" and "C" Stock.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TENDERS are invited for Lighting the City of S. PAULO (BRAZIL) BY GAS, and must be sent under sealed covers, marked "Illuminaçao a Gaz da Cidade de S. Paulo," to the Secretaria da Agricultura, Commercio, e Obras Publicas (Department of Agriculture, Commerce, and Public Works), in time to reach the said Department not later than Three o'clock p.m., on April 30, 1897.
Particulars may be had on application, by letter, to the BRAZILIAN LEGATION, LONDON; or to the BRAZILIAN CONSULATES in LONDON, LIVERPOOL, or GLASGOW.

CASES FOR BINDING
VOLUMES OF THE "JOURNAL"
(GREEN CLOTH, GILT LETTERED)
MAY BE HAD FROM THE PUBLISHER
Price 2s. each.

Price 6s., Cloth Bound,
THE CHEMISTRY OF ILLUMINATING GAS.
By N. H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.
LONDON
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.
LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . .	11,205 Cubic Feet.
Illuminating Power, $16\frac{7}{10}$ Stand. Sperm. Candl.	
Coke (of good & pure quality)	13¾ Cwt. Per Ton.
Sulphur	A little over 1 Per Cent.
Ash	Under 1 Per Cent.
Tar	163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.
RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . .	10,500 Cubic Feet.
Illuminating Power	17 Stand. Sperm Candl.
Coke (of excellent quality)	13½ Cwt. Per Ton.
Sulphur	1·13 Per Cent.
Ash.	1·34 Per Cent.
Tar.	180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THE "COOMBE" DRAUGHT SCREEN FOR INCANDESCENT BURNERS.

For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," Jan. 5, p. 46.

ALFRED ARCULUS & CO., Glass Manufacturers, BIRMINGHAM.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON, FITTER.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT WHETHER

MAKERS,
WHOLESALE DEALERS,
RETAILERS,
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,
11, Victoria Street,
Westminster.
Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

London Office: R. Cull, 34, Old Broad St., E.C.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

WATERBLEAN PAINT

Telegrams:
"EVESON, BIRMINGHAM."

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.
Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

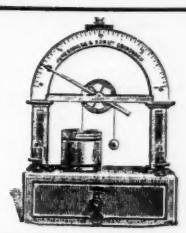
Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
For Prices and Particulars, apply to
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON
AND SONS, Limited,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

JAMES MILNE & SON, Ltd.,
GAS ENGINEERS,
MILTON HOUSE WORKS. EDINBURGH.
LONDON. — GLASGOW. — LEEDS.



No more NAPHTHALENE in Gas-Mains.
SUPER-CANNELINE
Is specially manufactured as an **Enricher of Coal Gas**, which, when used in Effective Vaporizers, will increase the Illuminating Power of Gas **at a Cost of ½d. per Candle**, as well as keep the Mains free from Naphthalene.
MANUFACTURED BY
S. BOWLEY & SON, Wellington Works, Battersea Bridge, LONDON, S.W.

MOBBERLEY & PERRY
STOURBRIDGE.
Manufacture & supply best quality of
Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)
Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c, &c.
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.
Contractors for the erection of Retort-Benches complete.
London Agents:
BALE & HARDY, Gas Engineers and Contractors,
BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

THE NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING COMPANY, LIMITED.

THE SUNLIGHT COMPANY having finally beaten the Welsbach Company in the Law Courts, notwithstanding the misleading statements which are being advertised, the Legal Position of its Mantle is now

ESTABLISHED BEYOND ALL QUESTION.

Mr. JUSTICE WILLS says in his Judgment: "No use is made by the Defendants (the Sunlight Company) of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be as wide asunder as the poles from those contemplated by Welsbach."

Therefore any interference with our Customers by the Incandescent Company in the use of our Mantles, either on our Burners *or on theirs*, should be promptly reported. **It will at once be summarily dealt with by us, without cost to our Customers.**

THE SUNLIGHT MANTLE gives a

SOFT MELLOW LIGHT, VERY

AGREEABLE TO THE EYESIGHT, AND HEIGHTENS THE

DECORATIVE EFFECT OF PLEASANT COLOURS.

WE ARE PREPARED TO *MAINTAIN ALL BURNERS* FITTED BY OURSELVES AT A VERY LOW PRICE PER ANNUM;

AND *SPECIAL TERMS* FOR *RENEWAL MANTLES* WILL ALSO BE MADE TO THOSE WHO PREFER TO DO SO THEMSELVES.

THE NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING COMPANY, LIMITED,

33 & 34, SHOE LANE, LONDON, E.C.

PREPAYMENT METERS.

SIMPLE IN ACTION. POSITIVE IN RESULTS.

ROCK METER WORKS,

TELEPHONE Nº 2145
Telegraphic Address
AUTOMATIC MANCHESTER

THE Automatic Gas Meter 1895 Corporation Limited,
Tariff Street Strangeways
MANCHESTER.
AND AT
40 Queen Victoria Street
LONDON.

ORDERS PUNCTUALLY ATTENDED TO.

The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.
HENRY GREENE & SONS,
153 & 155, CANNON STREET,
LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS,
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

LONDON OFFICE
60 QUEEN VICTORIA ST. E.C.

TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."

TELEPHONE Nº 43.
"HALIFAX EXCHANGE"

GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.

RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.

JONAS DRAKE & SON
SOLE AGENTS FOR
HISLOP'S
PATENT REGENERATIVE FURNACES
—FOR—
ENGLAND, WALES & ABROAD.
RETORT BENCHES ERECTED COMPLETE
WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.
OVENDEN HALIFAX

Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

BRAY'S "SPECIAL" GAS-BURNERS.

See that the Burners are Stamped "Bray's 'Special' Patent," or "Bray's 'Adjustable' Patent."

BRAY'S "SPECIAL" BURNERS save their cost in **40** hours' use, and during their average life **120** times their cost.

BRAY'S "SPECIAL" BURNERS last **30** times as long as Incandescent Gas-Burners, are one-thirtieth the cost, and have no fragile and short-lived Mantles, with their almost total absence of downward light.

BRAY'S "SPECIAL" BURNERS last **14** times as long, and give as much light at one-third the cost as Electric Lamps at their best.

THREE-FOURTHS OF THE BURNERS USED IN GREAT BRITAIN, and an equal quantity abroad, are of Bray's manufacture.

THE COTTAGER MAY SAVE AT LEAST 4s. A YEAR in his Gas Bill, and have better light.

IN OTHER WORDS, BRAY'S "SPECIAL" BURNERS may be purchased for **TWO PENCE,** and our common Burners, introduced 27 years ago, for One Penny. But users of the Penny Burners **WASTE SIXPENCE** in every 1000 feet of gas used, when compared with Bray's **"Special"** Burners. See *"Public Warning"* below.

COMMON BURNERS OF OTHER MAKES, as British Association of Science and other tests show, waste **15d.** per 1000 feet.

GAS COMPANIES should supply **"Specials"** to fight Electric and Oil Competition.

GAS-FITTERS should supply **"Specials,"** and save their customers' money; and consumers should demand **"Specials,"** and save their own money.

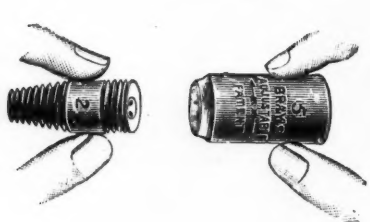
"ADJUSTABLE" Specials convincingly show the remarkable lighting and saving value of the **"Special"** principle. One test removes all doubt. See below.

ECONOMY. **BRAY'S IMPROVED BURNERS** have given an increased value of over **£1,400,000** a year to the gas used for lighting purposes in Great Britain and the United States, irrespective of other Countries.

HIGH TESTIMONY. **EXTENDED TESTS** by British Association of Science, the Gas Referees to the Board of Trade, the Glasgow Philosophical Society, the Government of the U.S.A. Gas Department, **and Congress by an Enactment in 1896,** proclaim that Bray's **"Special"** Burners are the best for general use.

PUBLIC WARNING. **WE WARN USERS OF GAS-BURNERS** that most dealers supply solely our commonest Burners, stamped "Bray's Patent Enamel Regulator"—excellent burners when introduced 27 years ago, but compared with our **"Specials"** they are inefficient. That the public may not be supplied with our commonest Burners, we show wood-cuts of Bray's **"Specials."** See that "Bray's **'Special'** Patent," or "Bray's **'Adjustable'** Patent" is upon every Burner purchased.

BRAY'S "ADJUSTABLE" SPECIALS.



Bray's "Adjustable" Specials differ only from our "Specials" in being in two parts—a top and bottom, which may be adjusted to suit any pressure of gas. A 5 top might require a 3 bottom for one pressure, and a 1 for another—the lower tip regulating the flow of gas; the upper tip burning it. To show the superiority of the "Adjustable" over ordinary Burners, light the ordinary bottom tip, then put the "Special" top one on, and a startling increase in light will be seen. This is how every buyer may PROVE FOR HIMSELF the marvellous value of our "Special" Burners.

As far as possible, we meet all requirements of the public with our "Specials;" but any buyer can suit himself by using the "Adjustable" Specials.

GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Preston	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Southport	750,000 ,,
Belfast (Second Contract)	4,500,000 ,,	Bath	1,000,000 ,,
Glasgow	300,000 ,,	New York	1,200,000 ,,
Brussels	700,000 ,,	Newburgh, N.Y.	350,000 ,,
Brussels (Second Contract)	700,000 ,,	St. Joseph, Mo.	750,000 ,,
Liverpool	3,500,000 ,,	Winchester	200,000 ,,
Tottenham	750,000 ,,	Hoylake	125,000 ,,
Tottenham (Second Contract)	750,000 ,,	Shanghai	225,000 ,,
Santiago	400,000 ,,	Holyoke, Mass.	600,000 ,,
Swansea	750,000 ,,	Stockport	500,000 ,,
Brighton	1,500,000 ,,		

And have now under Contract:—

Manchester	3,000,000 Cub. Ft.	Bordentown, N.J.	125,000 Cub. Ft.
Edinburgh	2,000,000 ,,	Lea Bridge	350,000 ,,
Stockton-on-Tees	500,000 ,,	Newburgh, N.Y. (Second Contract)	250,000 ,,
Norwich	1,000,000 ,,	Coventry	600,000 ,,
Guildford	350,000 ,,	Brentford	1,100,000 ,,
Syracuse, N.Y.	850,000 ,,		

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W. Telegrams: "EPISTOLARY, LONDON." *United States Office, 64, Broadway, New York.*

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

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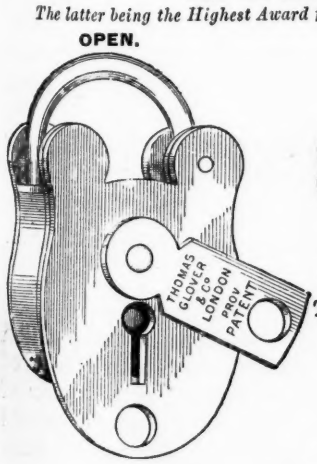

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PATENT

SECURE PADLOCK

Prevents Tampering with the

CASH-BOXES OF PREPAYMENT METERS.

The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark.

Eyelets easily fixed and removed by Company's Collector.

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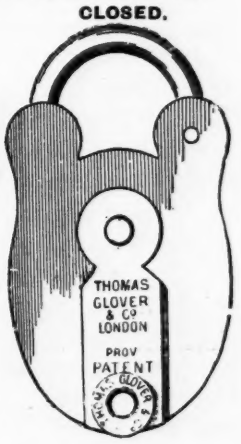


Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address: "GOTHIC"*

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

IMPROVEMENTS IN STREET LIGHTING.

Highest Efficiency with Greatest Economy.

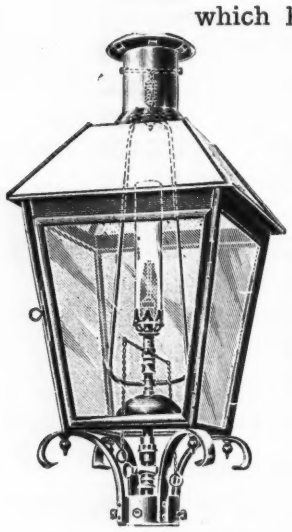
LIGHTING AUTHORITIES, GAS ENGINEERS, and GAS MANAGERS

are invited to inspect the

INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of

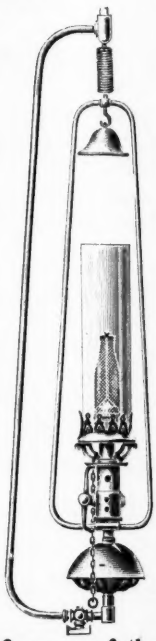


STREET LIGHTING,

the difficulties caused by VIBRATION having been OVERCOME by the use of the

NEW SPRING SUSPENSION FRAME (Patent).

This System of Lighting meets the requirements of all Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting WITHOUT INCREASE OF EXPENDITURE.



The following are Extracts from a PAPER read by Mr. F. G. DEXTER, before the SOUTHERN DISTRICT ASSOCIATION.

"The success of the experimental (Welsbach) lighting secured the contract for one of the Parish Council Districts; and this was shortly followed by the contract for three years for the city lamps. The total represents altogether about 500 single lamps, and 15 refuge lamps containing two lights."

"In the matter of maintenance of the street lights, the record is favourable—in fact, more so than the estimate provided. By the test-meter, the average daily consumption works out to 38 cubic feet per light, including bye-pass. The bye-pass consumes with a flame half an inch long, $\frac{1}{5}$ foot per hour. This represents 1000 cubic feet per lamp per annum. The average consumption per light, when in use, works out to 12,900 feet per annum, or about $3\frac{3}{5}$ feet per light per hour. The lighting is continued all the year round, from the average times of one hour after sunset to one hour before sunrise."

"The mantles have worked out to an average of three per lamp per annum; but, bearing in mind the absence of frost last winter, the writer believes that four mantles per light is more likely to represent average conditions."

"In the matter of cleaning, it may be said that the lanterns require less attention than with the ordinary flat-flame burner."

"The number of lights attended to per man averages 85."

"The 'Welsbach' Light is undoubtedly one of the greatest aids to successful competition that the Gas Industry has ever experienced. Its influence, while reducing the relative cost of light, has advanced the consumption of gas all over the country by the increased satisfaction of the existing consumers, and the attraction of others. The writer feels that its influence should not be confined to the house. It is capable of meeting every competitor in the street, from cheap oils to arc lights, in cost and in effect; and it is hoped that the foregoing experience may lead many others to seek its aid and to realize its efficiency."

FOR PRICES AND PARTICULARS, APPLY TO THE

INCANDESCENT GAS-LIGHT CO., Ltd.,

Palmer Street, Westminster, London.

COLUMNLESS HOLDERS.

Notwithstanding the antagonistic influence of firms who are not permitted to construct Holders on **GADD & MASON'S PATENT SPIRAL GUIDE SYSTEM**, their adoption grows larger every year. Intelligent Gas Engineers appreciate the **GREATER SAFETY** of these Holders, and the very great **SAVING IN COST** of from **20** to **30 PER CENT.** No first-class Engineer should now think of paying for so much Metal in the shape of Columns, and the Labour of Erection.

A few months ago the "JOURNAL OF GAS LIGHTING" referred to

"THE KNELL OF GASHOLDER GUIDE-FRAMING,"

which speaks volumes.

In order to meet the ever-increasing demand, we have granted **Licenses for the construction of our patent System of Holders, to a select few of the leading Gasholder Makers,** from whom Estimates and Particulars can be obtained.

Gas Engineers are enjoined to avoid Firms who talk twaddle about Columns giving greater strength, merely in order to obtain an Extra Price for the weight of Metal therein and the Labour in Erection. Prices of Materials and Labour are constantly advancing—a sufficient reason why all Engineers should place their orders with Firms who can give them our Holders, and so save considerably in first cost, as well as Repairs, besides getting a **STRONGER, SAFER,** and a **BETTER SYSTEM.**

The first Gadd and Mason Holder was erected some Eight Years ago at Northwich. It has withstood the most violent Storms (one of which brought down the chimney stack), and we believe up to now has not cost a single fraction for Repairs.

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GAS ENGINEERS AND IRONFOUNDERS,

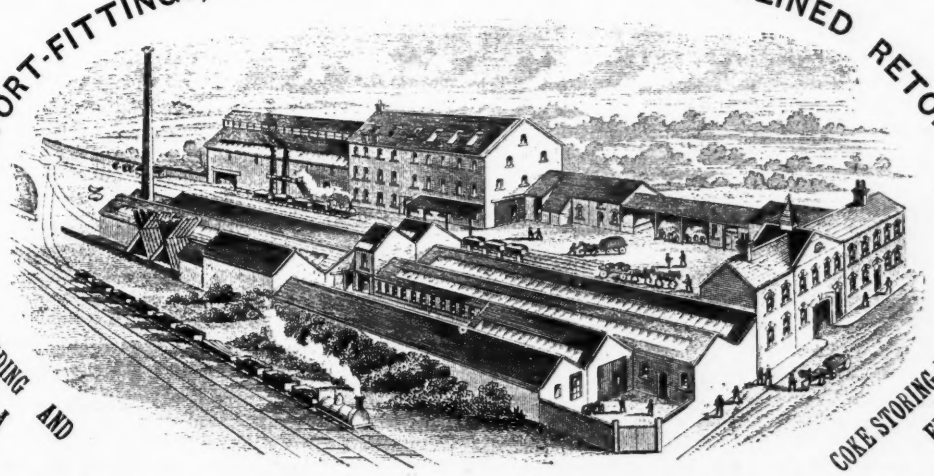
MAKERS OF ALL KINDS OF

PLANT AND MACHINERY FOR GAS-WORKS.

COAL-BREAKERS. COKE-SCREENS.

MOUTHPIECES. LIQUOR-TANKS.

RETORT-FITTINGS, REGENERATOR SETTINGS, INCLINED RETORTS.



COAL UNLOADING AND CONVEYING A SPECIALITY.

COKE STORING PLANT, ENGINES, EXHAUSTERS, VALVES.

BEEHIVE WORKS, **RETFORD,** NOTTS.

BOWENS' Ltd. Successors,
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MANUFACTURERS OF
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Established 1860.

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Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

WILLIAM INGHAM & SONS,
Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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MACHINE-MADE GAS-RETORTS.

OSLER,
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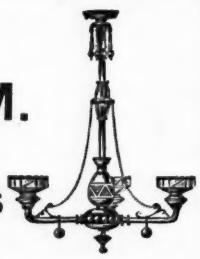
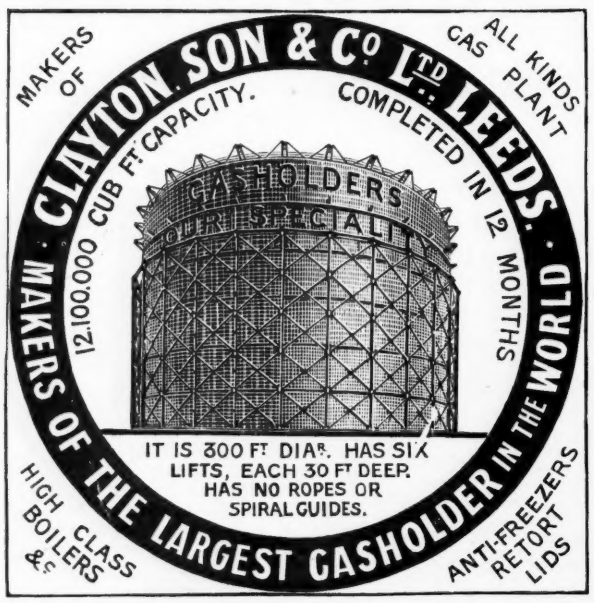
MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

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CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
COMPLETED IN 12 MONTHS
12,100,000 CUB FT CAPACITY.
GASHOLDERS
OTHER SPECIALITIES
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
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STOURBRIDGE
RETORTS AND FIRE-BRICKS.
BEST QUALITY.

KING BROTHERS, STOURBRIDGE.
[See Illustrated Advertisement, Jan. 5, p. 46.]

Gas-Bags for Mains. High Water-Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpauling Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber. Stokers' Gloves, 14s. 6d. per dozen.

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Patent Automatic Machinery
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Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
[See Illustrated Advertisement, Jan. 5, p. 53.]

PATENT TWISTED TAPER
RYMERS & TAPS.

These **Patent Twisted Taper Rymers and Taps** are the best ever made for Gas and Water Service Connections. A true Hole and a correct Thread can be assured. They are easy to work, and will last much longer than straight grooved Taps and Rymers.

THOUSANDS ARE IN DAILY USE.

Also SCREWING-MACHINES, STOCKS and DIES (with Patent Twisted Dies), PIPE-TONGS, and other TOOLS.

Apply for Prices and Particulars to
JOHN RUSCOE,
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IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

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The Apparatus has been supplied to the following Firms–

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Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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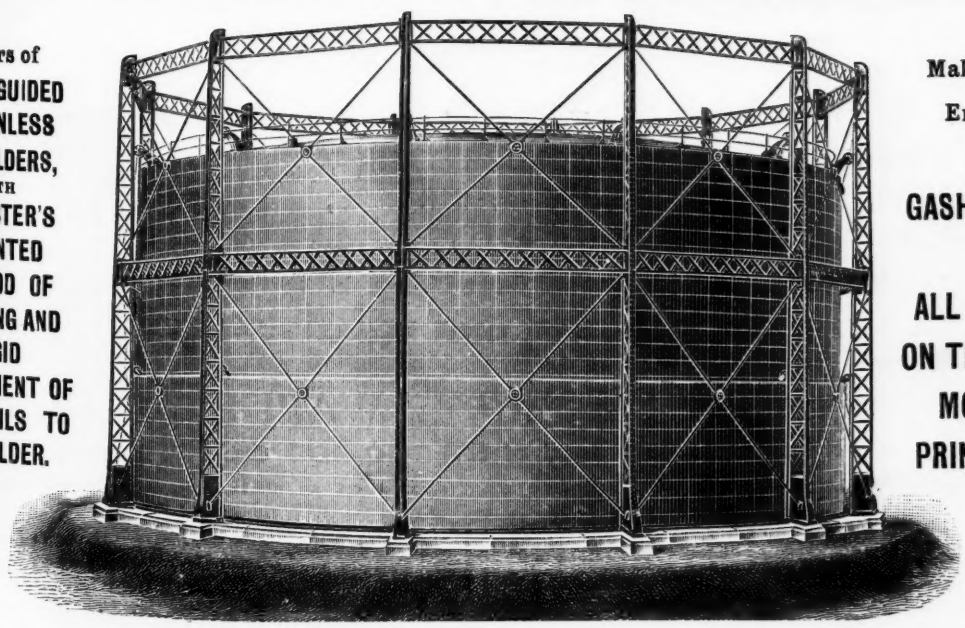

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PATENT LIGHT-DIFFUSING GLOBE.

Guaranteed to give more Light, with better Diffusion, than any Globe in existence.

X **We are now prepared to supply "HOLOPHANES" suitable for use with the "GEM" INCANDESCENT BURNER.** X

These "'Gem' Holophanes" are now made in two patterns—No. 28 (similar to No. 10), and No. 28/28 (similar to No. 10/10).

Prices, in clear Crystal, 2/4 each; in New PATENT ROSE TINT, 3/6 each.

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Wellington, Nelson, and Market Street Works,

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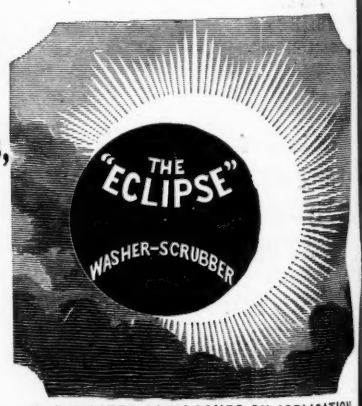

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GASHOLDER TANKS, COLUMNS, GIRDERS, LAMP-POSTS,

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GAS and WATER VALVES and MAINS. ILLUSTRATED CATALOGUES ON APPLICATION.

ALSO SOLE MAKERS OF

Laycock & Claphams' Patent "ECLIPSE" WASHER-SCRUBBER,

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Repeat Orders speak for themselves, some of which are given below—

		CAPACITY, CUB. FT.			CAPACITY, CUB. FT.
Sheffield United Gas Company	2 Machines	1,500,000 each.	Manchester Corporation. .	2 Machines	4,000,000 each.
Do. do.	2 ,,	4,000,000 ,,	Do. do. . .	1 Machine	3,000,000
Halifax Corporation . . .	2 ,,	3,000,000 ,,	Rochester, Chatham, & Strood . . .		1,000,000
Keighley Corporation . .	2 ,,	1,000,000 ,,	Do. do. . . .		1,500,000

CONTRACTORS TO HER MAJESTY'S GOVERNMENT.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Jan. 19, 1897.